ELEGIRICAL REVIEW FRIDAY **5 AUGUST 1960**

Vol167-6

ABERDARE PLASTIC INSULATED POWER CABLES

with pre-spiralled shaped conductors



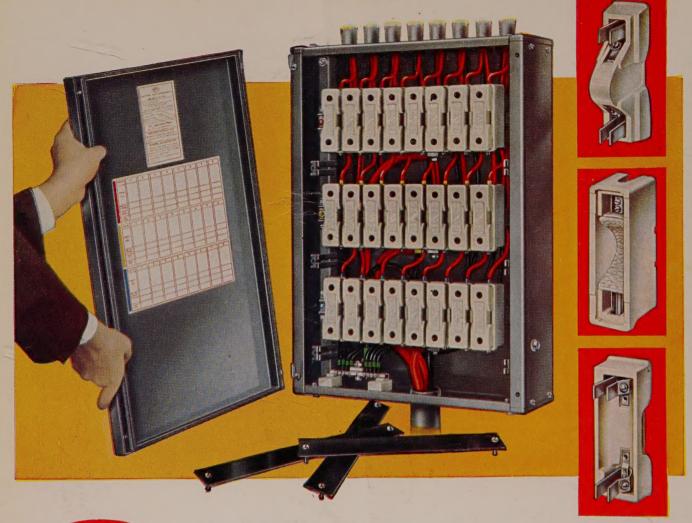
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also CONTROL & TELEPHONE CABLES

A Multi-core Control Gable, PVC insulated, PVC sheathed, wire armoured and PVC sheathed



Aberdare Cable ABERDARE CABLES LTD . ABERDARE . GLAMORGAN LONDON OFFICE: NINETEEN WOBURN PLACE . WCI - TERMINUS 2777





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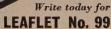
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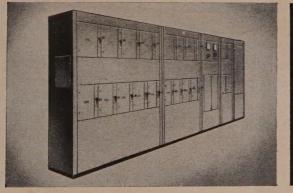
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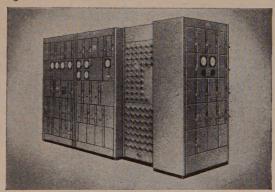


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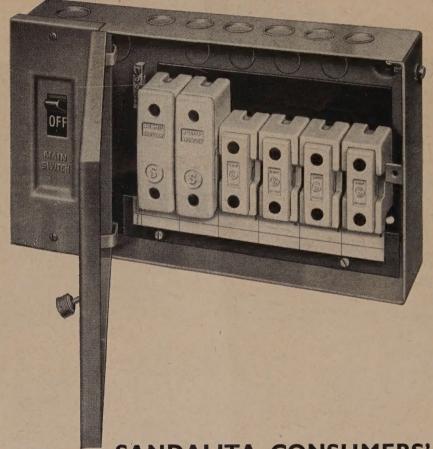
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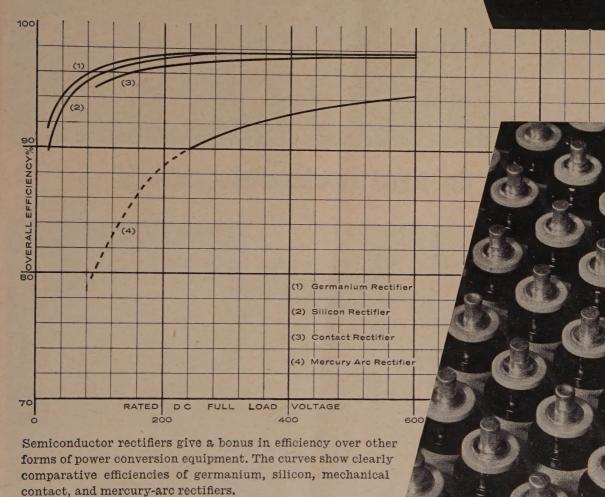
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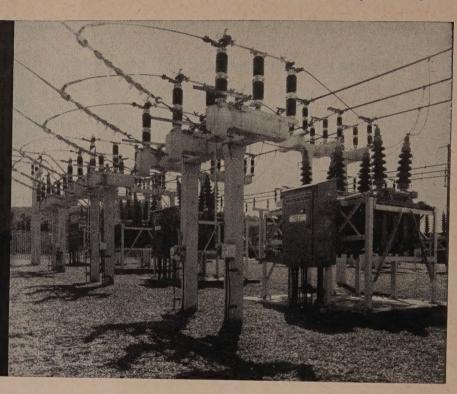
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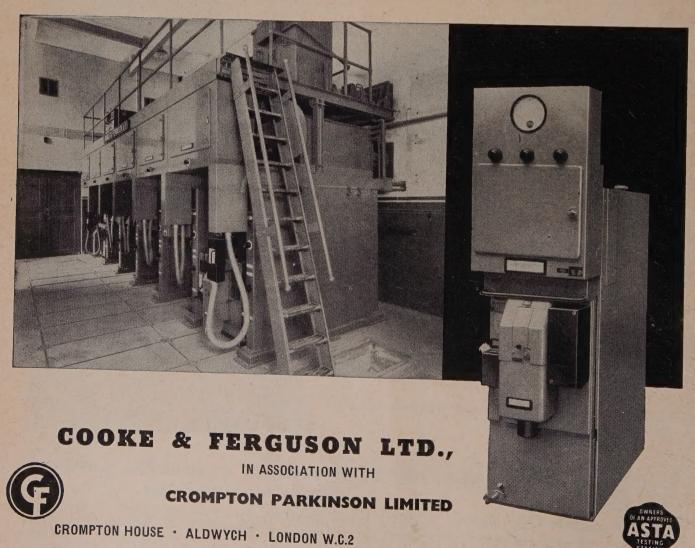
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The first 180 MVA, 3 phase, 132/275 kV auto-transformer to be completed for the Central Electricity Generating Board.

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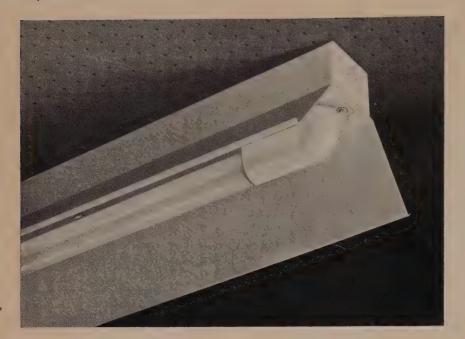
The Central Electricity Generating Board are just as concerned about this as they are about bringing in the power. For the nation has charged the Board with a double duty. Not only to maintain an efficient, economical electricity supply, but also to preserve the amenities of the country as they go.

That's why the new line will be planned so that it follows the dark background of a wood here; skirts a village there; crosses skylines in the most inconspicuous way to be found; and eventually reaches the town through its industrial suburbs.

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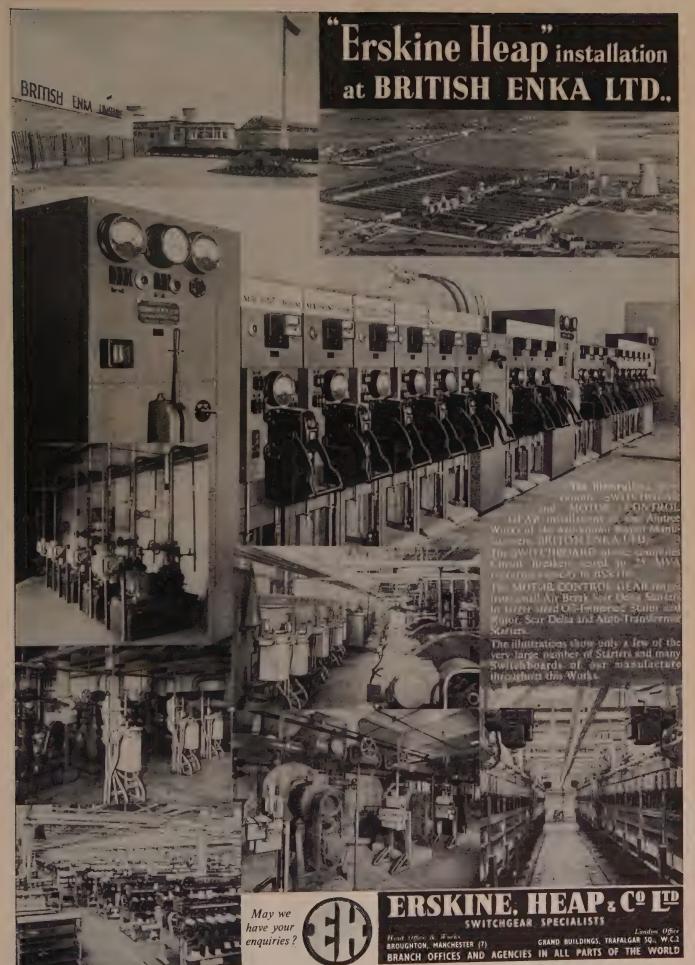
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Further types of wall brackets are detailed on page 20 of our 34 page illustrated Brochure 1453/ER and you are invited to apply for a copy. The Brochure also gives information of over 400 Tunion products.



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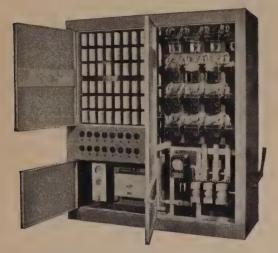
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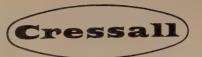
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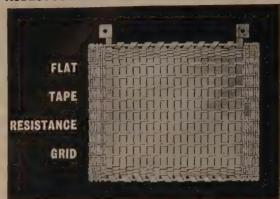
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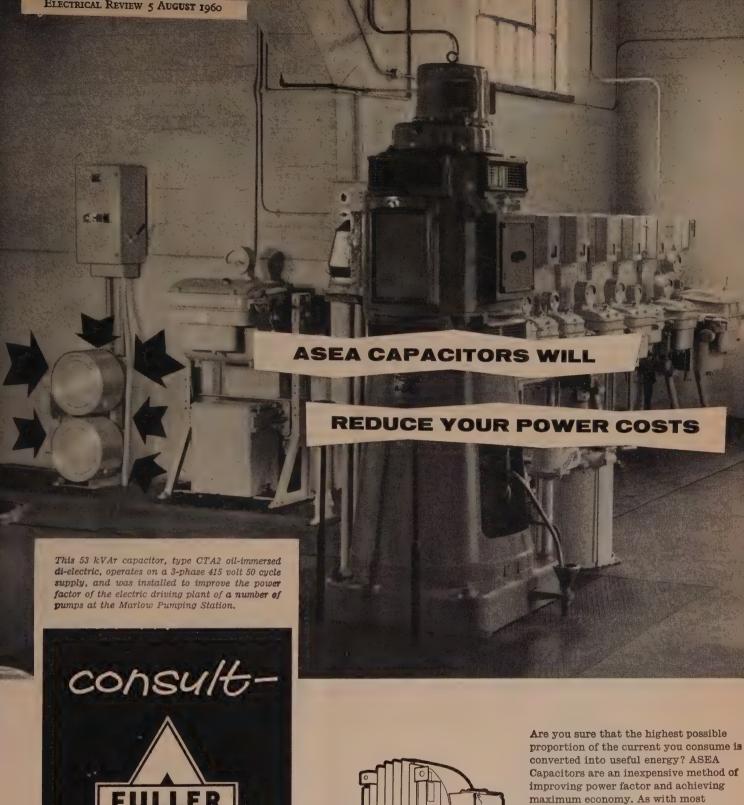
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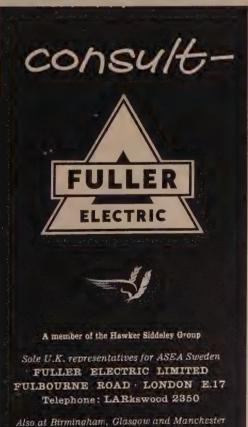
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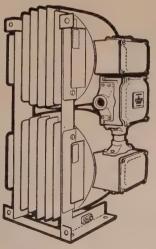
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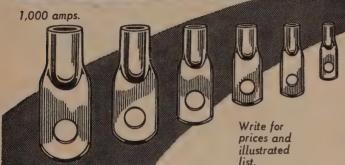
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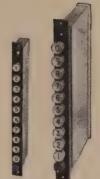
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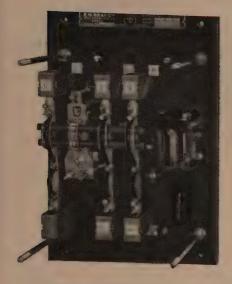
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ENBRAY CONTACTORS FOR EMERGENCY LIGHTING

15 AMPS



Type 2A Standard back connected model with dust cover

TO

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These contactors carry the British Standards Institution Kite Mark—A guarantee of Compliance with the exacting standards of B.S. 764



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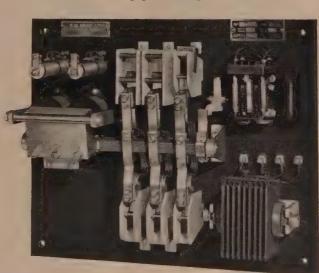
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Type 2C Standard back connected model for strap mounting

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I submit that the case for the

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is well and truly proved"



The QA external thermostat, incorporating a small electric heater, enclosed in a weather-proof case

And many Electricity Boards throughout the country

think so too. Practical tests have established the value and control

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The QR internal thermostat which ts mounted inside the building and set to the required room temperature



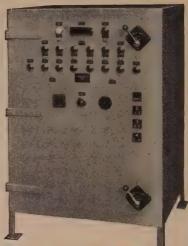
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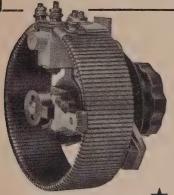
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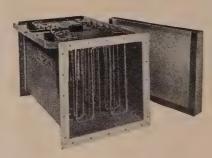
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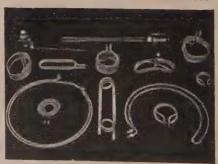
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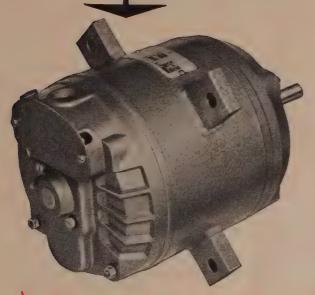


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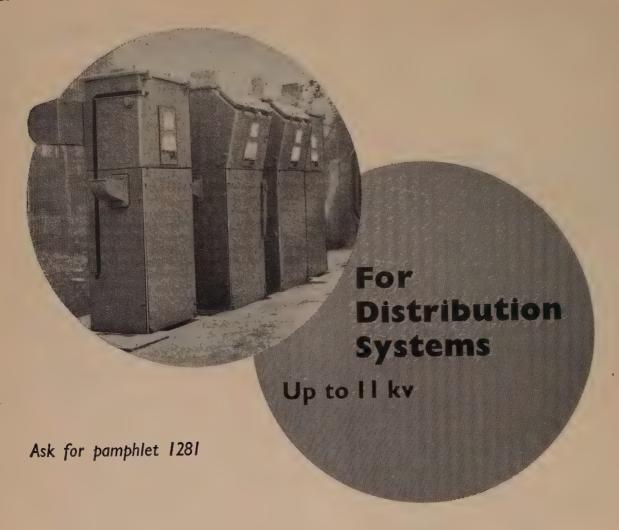
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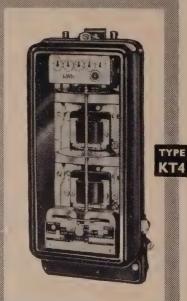
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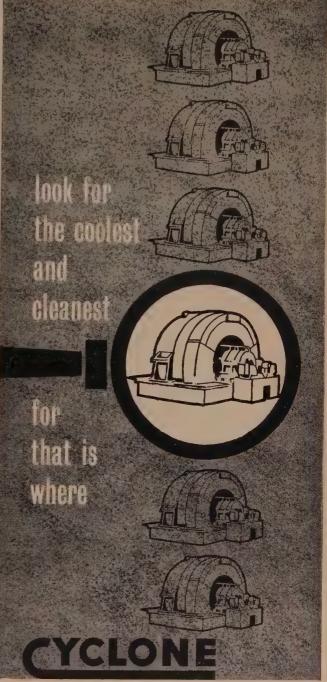


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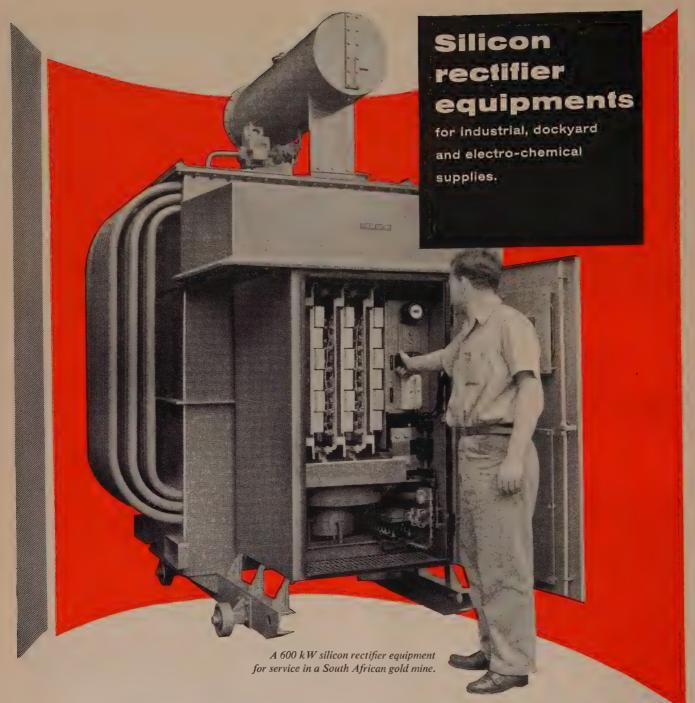
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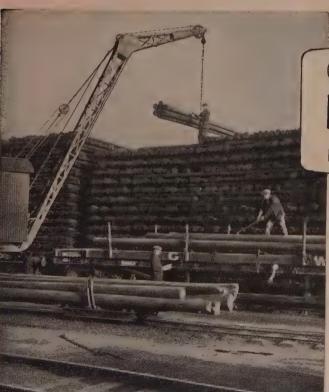


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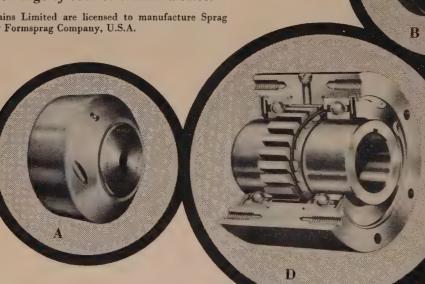
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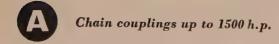
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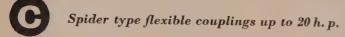
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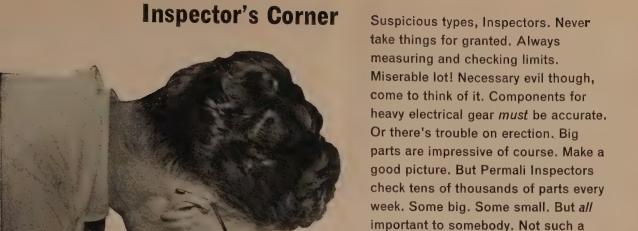












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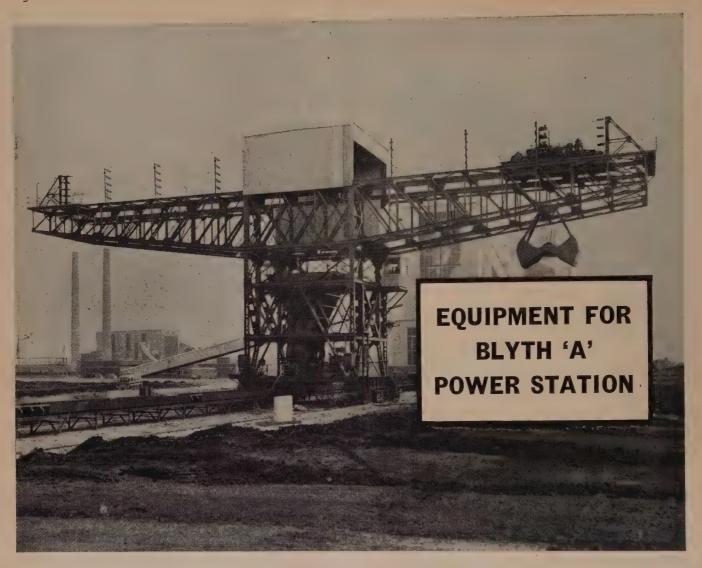
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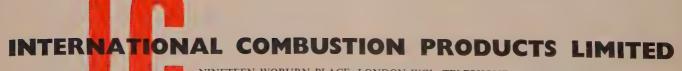
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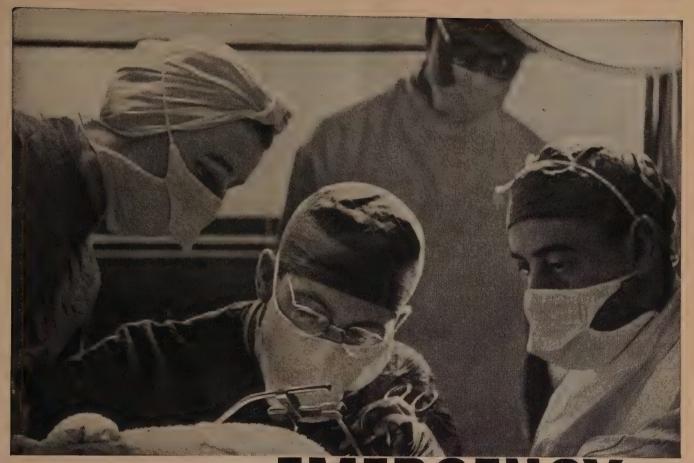
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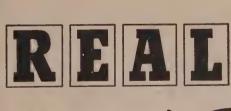
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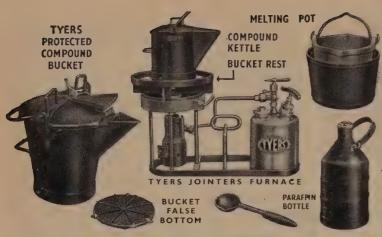


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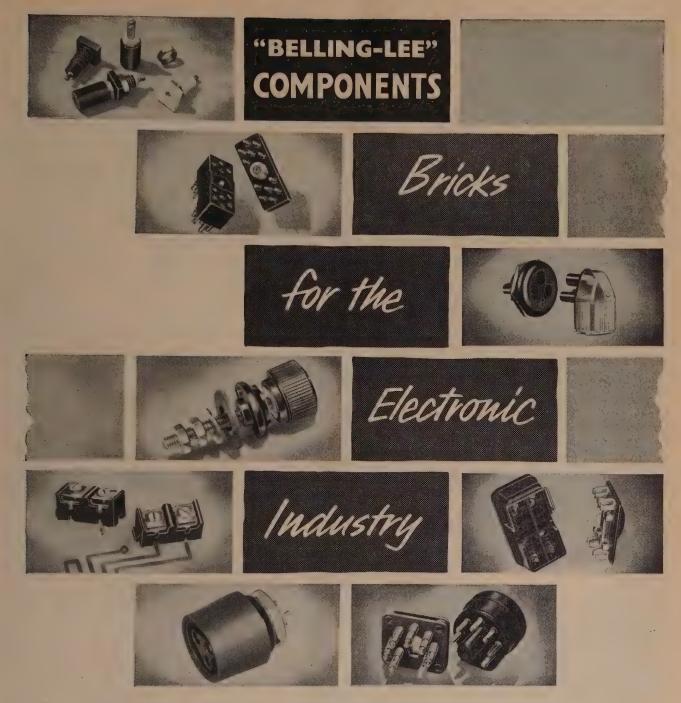
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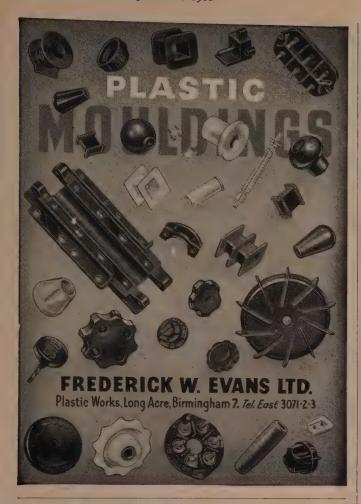
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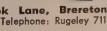
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ELECTRICAL REVIEW

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FRIDAY

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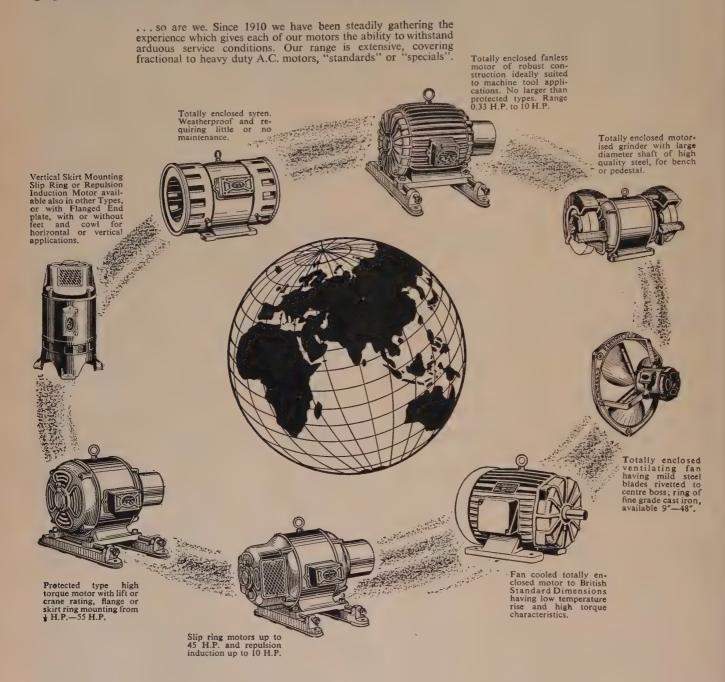
Eighty-Eighth Year of Publication

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P. 103A 107

ELECTRICAL REVIEW

5 August 1960 Vol. 167 No. 6 Established 1872

Electronics in Medicine

MEDICAL electronics is a branch of engineering which was virtually unknown ten years ago, but it has now grown up to be of sufficient importance to warrant the full paraphernalia of an international conference. The Third International Conference on Medical Electronics has just been held at Olympia, in conjunction with an exhibition in which both commercial firms and academic institutions have taken part, and a full report is published in this issue.

There is no doubt that medicine can benefit from the application of electronic techniques. Electronic instruments can serve as an extension to our human senses which are often inadequate when it comes to gathering diagnostic information. Not only do our senses lack acuity but, in some instances, we may also not even possess the appropriate "transducer." The cardiograph and X-rays were the first of a long line of diagnostic instruments which have today culminated in the X-ray television image

intensifier and the mass-spectrograph gas analyser.

Electronic instruments can also bring some measure of automation to the hospital laboratory in which samples are now gathered and examined almost routinely at any clinical investigation. Computers with suitable "memories" will, in the future, almost certainly extend automation to the keeping of patients' records and to the storage of medical information. The diagnostic computer, programmed with the best available information and preferably learning from its own mistakes, has often been forecast, and

has been applied experimentally to a limited extent.

Machines which take over the function of some organ, either temporarily during surgery or sometimes more permanently, also owe much to electronic and electrical engineering. Artificial respirators can now be synchronised to the patient's own feeble attempts to breathe, and heart-lung machines enable the surgeon to work on a heart temporarily disconnected from the circulation. Artificial kidneys have been used to tide a patient over a period of acute kidney disease, and the day of the artificial limb controlled by nerve impulses still sent to the stump is just dawning.

How are these devices invented or designed? Certain well-established types—X-ray apparatus for instance—are designed by industry, but more often the device originates in a hospital, university or a medical research

laboratory, and is then further developed by a commercial organisation. The people working in the medical laboratory may be engineers, physicists, or men with a biological training and a bent for instrumentation. Difficulties in communication between engineers and doctors have undoubtedly held back the even wider and quicker application of electronics to medicine. It is to be hoped that conferences such as the one which has just taken place will lead to better mutual understanding between the medical and electrical engineering professions with a consequent improvement in medical diagnosis and treatment.

ECONOMICS OF GENERATION

During the past few months there has been considerable discussion of the cost of generation by conventional and nuclear plant. Many different figures have been mentioned without any clear indication of how they are obtained or which items are included in the totals. Normally, generation costs per kWh do not include any part of the capital costs of the power stations. The argument here is that once the station has been built, then the load factor at which that station is required to operate depends purely on its running costs. If it supplies electricity at a lower cost than a cheaper capital-cost station, it would run at a higher load factor than the cheaper station.

Capital costs are only included in the overall generation costs when deciding which stations are to be built, and their size and type. Thus the Central Electricity Generating Board's annual report contains running cost figures only, while the United Kingdom Atomic Energy Authority is more interested in overall figures. Before building a nuclear power station, the following figures are discussed: Overall cost of generation by the best new conventional power stations, 0.5-0.6d/kWh; by magnox nuclear stations, 0.7-0.8d/kWh; by the A.G.R. nuclear stations, 0.6d/kWh; and by hydroelectric stations, 0.6d/kWh, assuming the same load factor operation throughout.

Once these stations have been built, figures for running costs only are used to determine the load factors of each station. Average estimated figures are as follows: the best new conventional power stations, 0.4d/kWh; magnox and A.G.R. nuclear power stations, 0.3d/kWh; and hydro-electric stations, 0.1d/kWh.

LOW-TEMPERATURE HEATERS

Next week's issue of the Electrical Review will include, as a self-contained detachable supplement, an illustrated survey of low-temperature heaters suitable for domestic use, including convectors, radiators and fan heaters. The details given will include size, element loading, finish and price as well as the name and address of the maker or distributor

These are works costs, that is, the price of electricity at the station busbars, and do not include costs of transmission, distribution, etc.

CONTROL SYSTEMS

The rubber industry was one of the earliest to exploit the possibilities of automatic control, and for more than thirty years development has continued on systems for their somewhat specialised processes. In the article "Automatic Control Systems" on page 239 several of these are described, from a comparatively simple golf ball sorter to control for an automatic bias cutting machine for rubber tyre fabric and an edge trimmer incorporating a distance memory system. All of these have been developed to meet a specific requirement and have resulted in improved manufacturing speeds and quality consistence.

Mention is also made of a scheme, basically an extension of the edge-follower using four edge-sensing photocells, developed to lay a rubbered cambric breaker strip centrally between the beads on flat built tyre casings. Although satisfactory operation was obtained a considerably simpler mechanical method was adopted. It must be remembered, however, that in this case the accuracy obtained by the electrical method was in excess of requirements and use of the simple device was more than justified. We wish that the reverse procedure operated more frequently, for there are many present-day operations manually or even mechanically governed which would benefit substantially from control of improved accuracy.

A FRIENDLY CHALLENGE

Now that the health and other services provided by the State cater for so many needs it is easy, but mistaken, to assume that private charities are no longer necessary. The annual report of the Electrical Industries Benevolent Association leaves no doubt of the many cases that still remain where the Association can provide assistance of a type and in a way unobtainable from official sources. Last year it "reached a new height of achievement and endeavour." More people received help, and happily, more funds were provided. One result of the satisfactory financial position is that much-needed extensions at Broome Park will now be possible.

Obviously, more money could be usefully spent and it would soon be forthcoming if the example set by employees of the Electricity Boards was emulated by their colleagues in the manufacturing and other branches of the industry. Personal contributions from the supply industry work out at 3s 3d per head of the total employed; the figure for the rest of the industry is only 8d. The better performance of Board employees owes much to the fact that their contributions are widely made as a regular deduction from their pay. But, whatever the reason, this wide discrepancy in support for the E.I.B.A. provides a friendly challenge that should be met without delay.

Radio pill — a completely selfcontained "swallowable" telemetering system. (Medical Research Council)



Medical Electronics Conference

From a Correspondent

The Third International Conference on Medical Electronics held at Olympia (21st to 27th July) was organised by the Institution of Electrical Engineers in conjunction with the International Federation for Medical Electronics. In conjunction with the conference there was an exhibition in which both commercial firms and academic institutions took part



Multi-bed ward thermometer for the centralised measurement of body temperature of a number of patients. (Edinburgh University)

THE technical sessions of the International Medical Electronics Conference at Olympia were organised roughly according to various systems in the body, such as the motor and nervous systems, the circulatory system and the respiratory system, with additional sessions on subjects such as efficiency, reliability and safety of hospital and medical electronics equipment, and medical electronics in aviation and space flight.

In the exhibition the intrusion of electronics began at a level as mundane as the stethoscope, which is familiar to us all. Faraday Electronics showed a stethoscope with a built-in transistor amplifier and two outputs so that two people can listen-in simultaneously. The amplifier can also be used separately from the stethoscope as a general purpose pre-amplifier. It should make the physician's task easier in detecting some of the finer nuances of our internal noises.

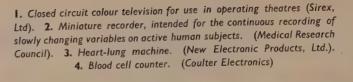
An example of automation invading even the hospital ward is a multi-bed ward thermometer exhibited by Edinburgh University, which allows one nurse, at some central point, to monitor the body temperatures of up to ten subjects continuously. The sensing organs are worn strapped to the arm and do not interfere with the patient in any way. The machine, unfortunately, does not provide any analogue to the visit of the pretty nurse to the bedside! The temperature is sensed by a small thermistor which is matched to the machine by a combination of series and parallel resistors which compensate for variations in resistance from one thermistor to another. They also help to give the instrument a more linear scale.

Another example of hospital automation is the automatic electronic blood cell counter exhibited by Coulter Electronics. This operates according to a particularly ingenious principle. A tube containing an electrode is closed at one end; the closed end has a small aperture in

it, in this case about 100 μ in diameter. The tube dips into a suspension of blood cells made by diluting a known volume of blood with a known volume of diluent, and another electrode is put into this. If an attempt is made to pass current from one electrode to the other, the whole system being full of liquid, the resistance is almost entirely a function of the area of the aperture. If now a small negative pressure is applied to the tube such as to draw the cell suspension slowly through the system, there will be a reduction of current every time a blood cell passes through the aperture. For this purpose blood cells can be considered almost as non-conducting particles. The current pulses are counted by a conventional scaling system and displayed in digital form. A mercury manometer metering system ensures that an accurately known volume of cell suspension is drawn through the system. The machine is also suitable for size selection because it is claimed that the reduction in current is proportional to cell volume, so that discriminator techniques can be employed such as to count only current pulses above a certain size or between two size ranges. An instrument of this type should certainly save time in a hospital pathological laboratory. It is unfortunate that many hospital authorities are as yet not aware that a machine even as expensive as this (f,1,000) will pay for itself in terms of technicians' salaries in a relatively short

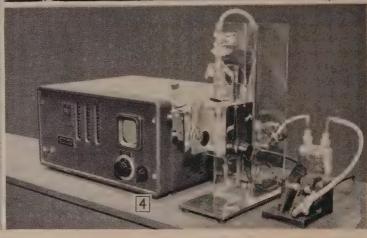
Even bigger, both financially and physically, is the X-ray image amplifier displayed by Marconi. Whenever patients have to be X-rayed in such a way that an image is viewed by the doctor directly on a fluorescent screen, the image intensity is so low that prolonged dark adaptation is necessary on the part of the viewer before any useful detail can be distinguished. Increasing the brightness of the image by increasing the X-ray intensity











is precluded by consideration of the X-ray dose which it is permitted to give to the patient. The image amplifier gets over this limitation by projecting the fluorescent screen image on to the target of a sensitive image orthicon, fairly standard television technique being used from there onwards. The method has the enormous advantages that not only can the X-ray dose be reduced somewhat but also a picture can be displayed on a number of television-type monitor receivers which is sufficiently bright to be viewed in ordinary daylight. Various electronic tricks also allow the contrast of the image to be varied at will, and it can also be turned from a positive into a negative. Even more attractive seems the suggestion to ally this technique with a memory cathode-ray tube (English Electric Valve Co., Ltd.) which has the ability to retain a picture for many hours. It would thus be possible to expose the patient only momentarily to the X-ray beam and then to examine the image at leisure.

Television in a more conventional form now enables students to have a "surgeon's eye view" during operations. Sirex, Ltd., showed a complete closed-circuit colour television equipment suitable for use in the operating theatre. The camera looks at the field of operation through a 45° mirror, and a hole in the shadowless lamp above the operating table. The camera can be controlled from an external console and the picture can be distributed to a number of receivers. This technique should certainly prove to be an aid to the teaching of surgery, because the congestion around the operating table in a modern theatre is such that the number of students who could be accommodated is very limited.

One whole session of the conference was concerned with telemetering from the digestive system. So-called endoradiosondes or radio pills have been developed in a number of centres. They are sub-miniature self-contained radio transmitters small enough to be swallowed. Typical dimensions would be those of a cylinder 23 mm long and 9 mm in diameter. The transmitter in the pill is fitted with a suitable transducer which varies the frequency of transmission in response to changes in the environment. Most pills work in the frequency band between 350 and 500 kc/s and have a frequency deviation

of 5 to 10 per cent for full-scale change of the variable. Depending on the design, the internal battery will supply power for periods between 40 hours and three weeks.

The Medical Research Council exhibited pills sensitive to pressure or temperature, together with a prototype design for a pill sensitive to pH, using a glass electrode. The design of the pressure- and temperature-sensitive pills is such that they can be produced relatively cheaply and can be regarded as being expendable. Another pH-sensitive pill was shown by Meditron, in which the problems associated with the high impedance of the glass electrode are avoided, possibly at some sacrifice of longterm accuracy, by the use of an antimony electrode. The electromagnetic field of the pills is detected by single- or multiple-loop aerials put close to or on to the surface of the patient. These feed receivers in which the incoming signal, sometimes after conversion to another intermediate frequency, is mixed with the output of another oscillator to produce a beat frequency which changes rapidly with changes in the pill frequency. After pulse shaping and integration, a d.c. signal can be derived which is suitable for driving a recorder. Much ingenuity has been expended on the problem of aerial design to avoid loss of contact when the pill is in such a position as to induce no signal in the pick-up loop. A successful system was described by Prof. B. Jacobson of the Karolinska Institute, Stockholm, in which three mutually perpendicular loops are used which are sequentially scanned by the receiver, suitable clamping circuits tiding the receiver over short periods of loss of signal.

The use of radio pills has given medicine a new territory to explore. Only the first and last few feet of the gastro-intestinal tract are accessible to conventional measuring instruments, and then at considerable discomfort to the patient. The region in between is almost unknown, and it remains to be seen whether clinically important information can be obtained from it.

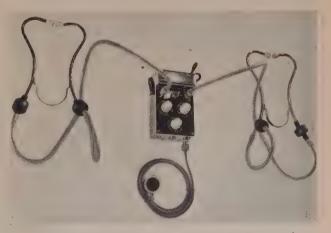
Artificial Voice

Another (interesting device meant to be worn inside the body is Dr. Tait's "artificial voice." Patients who have had their larynx removed are no longer able to make a sound by exciting their vocal chords, which would then be modulated by the lips and tongue to form intelligible speech; they are therefore dumb. Dr. Tait's appliance consists of a modified deaf aid earphone, mounted in the top half of a set of dentures, which is driven very hard by current pulses from an external unit connected to it by a thin flexible lead. Because of the large overload the earphone produces many harmonics in addition to the fundamental frequency at which it is being driven, giving rise to a sound which can only be described as "basic Donald Duck." This sound, after a little practice, can be modulated by the wearer to produce perfectly intelligible speech. On some of the more refined units provision is made to switch the oscillator off between words, which further improves intelligibility. The wire coming out of the corner of the mouth is a bit of a nuisance, and another version has therefore been constructed which is completely self-contained in the upper half of a denture, including a miniature rechargeable battery. Dr. Tait is considering a further sophistication in which the oscillator can be switched on and off by radio control from the trouser pocket.



Automatic ultrasonic scanning equipment. (Western Infirmary, Glasgow, and Kelvin & Hughes, Ltd.)

A machine which temporarily replaces a group of organs of the body is the heart-lung machine shown by New Electronic Products. Previous to the invention of machines of this kind, surgery on the heart was almost impossible. The reason for this is that it is not permissible to stop the heart for any length of time because some tissues, particularly the brain, unless continually supplied with fresh oxygenated blood, can be damaged permanently in as little as five minutes. The heart-lung machine can take over the duties of both the heart and the lungs. Blood which has passed through the circulation is drawn into the machine, spread out into a thin layer, and brought into contact with gaseous oxygen. Here it will give up its load of carbon dioxide and resaturate itself with oxygen, a process identical with that which would have occurred in the lung. The oxygenated blood is returned to the circulation. In the meantime the surgeon has been able to work on a stationary, bloodless heart to effect whatever repair was necessary. The operation of the machine has to be monitored by instruments which measure the oxygen and carbon dioxide concentrations in the blood; it is these



Stethoscope with transistor amplifier. (Faraday Electronics)

factors, amongst others, which control the circulation in the intact man.

The human heart can also become faulty in a way which is not amenable to surgery. The beating of the heart is controlled by a kind of master oscillator called the pace-maker. This produces electrical impulses which stimulate the heart muscle to contract. Nerves connected to the pace-maker control its frequency of discharge, and thus the rate at which the heart beats. The pace-maker can become unreliable, and attempts have been made to supply the necessary impulses by electronic means. At least two workers have now described miniature transistorised pulse generators, powered by a rechargeable sealed battery, which can be attached to the inside of the body wall. Wires from there lead to electrodes attached to the heart muscle. The battery can be recharged at intervals by inducing currents in an internal coil connected to the battery through a rectifier, by means of an external a.c. field. The design of the electrodes is not easy because of fatigue problems, the heart muscle contracting at least 50,000 times per day.

Ultrasonic Probe

X-rays have now lost their monopoly as a method of looking inside the patient. Prof. Donald at the Western Infirmary in Glasgow, in conjunction with Kelvin & Hughes, has developed a method by which structures inside the body can be revealed by their ability to reflect short pulses of ultrasonic energy. A probe, which is automatically kept in contact with the skin, transmits bursts of ultrasound a few microseconds long into the patient's body. Discontinuities in the tissue reflect some of the incident energy, which appears in the form of an echo back at the probe. The probe also serves as the echo detector and feeds the signal to a cathode-ray tube display. The speed of propagation of sound in tissue is known, so that the interval which elapses between the

pulse and the echo is a measure of range. By arranging the probe to scan a line around the patient an echo cross-section can be built up. Such a picture, however displayed, will, of course, be different from an X-ray picture, because X-ray absorption and the ability of a discontinuity to reflect sound pulses are not necessarily correlated. The advantage of this technique is that it avoids the use of X-rays and the associated radiation danger, and that it is possible to detect changes in soft tissue which would have been difficult or impossible to detect by other means.

Physiological Research

All the devices described so far have dealt with disease; this does not mean, however, that medical electronics in its wider sense does not have a contribution to make to physiological research and to the measurement and control of the environment in which we live. Diseases which affect relatively large sections of the population, such as bronchitis, lung cancer and heart disease, are almost certainly associated with our environment, how much we work, or some habit in our allegedly normal way of life. One way of finding out more about such diseases is to compare on some scale two populations in which the incidence of some disease is markedly different. This requires instrumentation of the normal healthy man in a form acceptable in everyday life. Miniaturisation methods have an obvious place here, but little work has as yet been done on this subject. A partial approach to this problem is a miniature chart recorder shown by the Medical Research Council. It is of the self-balancing potentiometer or Wheatstone bridge type. Plug-in resistors enable it to work with a wide range of sensing devices which can be matched to the recorder, provided that they translate the variable to be measured into a resistance change, a voltage (down to 5 mV full scale) or a change in voltage. The complete instrument weighs 4 lb, contains enough stored power for 100 hours of operation, and will work at ambient temperatures from -40° C to $+50^{\circ}$ C. The recording is made on a circular chart 2in in diameter driven by a clock, different versions of which will rotate once in one hour to once in five days. Medical electronics is undoubtedly a subject which

Left: X-ray image amplifier. (Marconi Instruments, Ltd.) Below: Display storage tube, and closed circuit television system. (English Electric Valve Co., Ltd.)



captures the imagination of the electronic engineer. One contributor to the conference whose duty it was to interview young graduates for jobs in his organisation said that 40 per cent of the applicants spontaneously suggested that they would like to apply their talents to medical instrumentation.

Industry, when entering the medical instrumentation field, faces two difficulties. The first is that the market is small and the financial returns are often not commensurate with the effort which has to be put into the project. The second problem is that industry has great difficulty in obtaining a specification for a new instrument from the medical profession. This is essentially a problem of communication, both between the medical profession and the manufacturer and within the medical profession itself. The opportunity provided by the conference was taken to

announce the formation of a new British learned society called the Biological Engineering Society, which has as its objects both to bring together experts in the field and also to provide firms, who can become affiliated members, with an organisation where they can meet the potential users of their instruments, pick up new ideas, and obtain an integrated opinion of the potential value of a suggested new development. The new society might go some way towards bridging the communication gap.

The conference was attended by about 800 delegates drawn from at least 20 countries, and more than 50 per cent of the exhibitors came from abroad. A number of social functions allowed members to meet each other while mellowed by food and drink, and furthered the spirit of goodwill which seemed to pervade the conference as a whole.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication.
Responsibility cannot be accepted for the opinions expressed by correspondents.

Trolley-buses and Public Health

IN the letter under the heading of "Satisfactory Passenger Transport" which appeared in your issue of 8th July and the article on trolley-buses in the 27th May issue brief mention was made of the question of public health.

Several years ago the Manchester Corporation gave consideration to a large extension of trolley-bus services, involving the conversion of about eight of the main bus routes. The primary advantages claimed were silence and the avoidance of exhaust fumes in a built-up area, there being a widespread feeling that this was endangering public health. The whole scheme was thrown out on the pretext of the heavy cost of equipping routes for trolley-buses, although it is generally known that-due to the long working life of both overhead equipment and trolley vehicles—the overall cost over a period of years favours the trolley-bus. It was decided, however, to retain all existing trolley-bus services and the matter was allowed to drop. Some three years later, the Transport Committee put forward a recommendation to the City Council that the Moston Road group of trolley-bus routes should be replaced by a "through diesel bus service" and got away with it. More recently the same tactics have been employed and two more services have been converted, one involving the Ashton-under-Lyne Corporation which was forced to trot in Manchester's footsteps as a joint operator, on the Guide Bridge route.

At South Shields, two years ago the Transport Committee recommended the abandonment of the Marsden trolley-bus route, for the extraordinary reason that the briny atmosphere caused excessive wear on the trolley wire. This thin excuse was swallowed and the Committee then recommended the total abandonment of its trolley-bus services, despite the fact that they have consistently made a handsome profit whereas the buses have not. This time, however, the Council was not so easily persuaded and, because of silence of operation and

the advantages of a system devoid of any form of air pollution, the proposal was turned down and it was decided to retain trolley-buses. Now, after a period of quiescence, the Transport Committee has come up with a proposal to abandon the main, and most recently-constructed (post-war), route to Ridgeway because a new roundabout is to be built and this would involve buying some poles and a few extra overhead fittings.

My purpose in alluding to but two of a number of cases is to stress to the electrical industry that one of the most efficient forms of transport is fast being superseded for reasons which do not bear investigation. As a doctor, I am concerned at the incidence of respiratory diseases in built-up areas, and this seems to be the foremost of several good reasons why electric traction should be used to its maximum in urban areas.

I would point out that the B.M.A. in 1956 recommended that no more diesel vehicles be put on the road because they very probably caused lung cancer with their fumes. One can only urge that every possible effort should be made by the electricity authorities to see that power for traction purposes is available at tariffs which are attractive to transport operators in competition with heavy oil.

" М.В., Сн.В."

Symposium on Automatic Control

FOLLOWING the recent First International Congress of the International Federation of Automatic Control, held in Moscow, at which the British contribution consisted of twenty-nine papers, the Institution of Mechanical Engineers has now arranged for discussion of the British papers at a symposium to be held at the Institution, I, Birdcage Walk, London, S.W.I, on 27th and 28th September. Reprints of the papers will be supplied to those registered to attend the symposium, and a list of the papers, together with registration forms to attend, can be obtained from the secretary of the Institution.

MOTORS FOR THE CHEMICAL

The use of electricity in many fields of the chemical industry was for years almost wholly confined to lighting, motive power being supplied usually by steam engines. Extensive use is now made of individual electric motor drives. The chemical industry raises special problems due to chemical corrosion and possible flooding by corrosive liquors, while some chemical plants handle materials which create an explosion hazard. In this article some of the methods used to overcome these problems are described, and details are given of the characteristics of the various motors and control systems employed

IN line with public supply practice, many early electrical installations in the chemical industry utilised d.c., the source of power being a small generating plant within the works. At this time the capital costs of d.c. installations were comparable with those of a.c. schemes, but in the past three decades a number of factors have contributed to an almost complete change-over to a.c. systems. The relative cheapness of energy bought from the public supply system has encouraged the smaller users to abandon generation in favour of a bought-in a.c. supply, and the growing size of chemical works has brought about a change to a.c. because d.c. systems required to meet the large demand for power would be far too expensive and unwieldy. The development of manufacturing facilities for a.c. squirrel cage motors on mass-produced lines has caused the gap between a.c. and d.c. motor prices to widen so much that for many applications d.c. motors become a most expensive luxury.

Dimensional Standardisation

It is no exaggeration to say that the introduction of standard dimension motors marked the beginning of a new era for the user. Machines to B.S. 2083 (dimensions of three-phase electric motors) have now been in use for five years and have proved themselves to be very satisfactory. The use of standard leading dimensions is a great convenience in the design office, procurement is usually rapid, and it has become almost unnecessary to hold spares. It is, of course, well known that the B.S. 2083 motors were based on the American standards issued by the National Electrical Manufacturers' Association (N.E.M.A.) and outputs were determined by the stipulation that insulation was to be Class A, with a 50°C temperature rise. (B.S. 2083 was revised in 1956 and one of the modifications was to change the performance specified from B.S. 168 to B.S. 2613 (electrical performance of rotating electrical machinery).) Shortly after B.S. 2083 was issued the National Electrical Manufacturers' Association issued new standards. Although the majority of frames in the new standards were identical with those of the previous N.E.M.A. standards, a number of new frames were introduced in the lower horsepower ranges which differed from those previously used.

In 1958 B.S. 2960 (dimensions of three-phase electric motors with ventilated enclosures) was issued to cover the dimensions of motors with ventilated enclosures. The frame sizes of this range, with the exception of the

two smaller sizes, are to the new N.E.M.A. standards, and ratings assigned to these frames are based on Class E temperature rises, i.e. 65°C. Neither B.S. 2083 nor B.S. 2960 make any reference to performance, which is governed by B.S. 2613. The table shows the rating and frame sizes of motors in the United Kingdom and North America. (Canadian national standards are identical with N.E.M.A. standards.)

The chemical industry generally has a wider application for totally enclosed machines than ventilated machines and may, in addition, call for additional features which are not normally incorporated in totally enclosed machines. Thus, manufacturers are now producing variations of the B.S. 2083 machines which are generally known as "chemical works types." Features which have been included under such general descriptions are

FOUR-POLE RATINGS FOR THREE-PHASE SQUIRREL CAGE INDUCTION MOTORS, N.E.M.A. AND BRITISH STANDARDS

	Horse-power									
Frame Size	Type 40°C	ise. Open Rise. Flp. Rise	T.E. 55°C Rise B.S. 2083	Ventilated 65°C Rise B.S. 2960						
	Old N.E.M.A.	New N.E.M.A.								
162 164 182 183 184 203 204 215 224 225 254 226 284 286 324 326	2 3 5 7½ 10 15 20/25 (open) 20 (T.E. & Flp.) 30 (open) 25 (T.E. & Flp.)	1 1½/2 3 5 7½ 10 15 20 25 (open) 30 (open) 25 (T.E. & Flp.)	1 1½ 2/3 5 7½ 10 15 20	1 1 1 1 2 2 2 3 5 7 1 2 10 15 20 25 30 40						

INDUSTRY

By F. H. MERRILL, B.Eng., M.Sc., M.I.E.E.*

Three A.E.I. 1,100/550 h.p. d.c. motors and two 800/368 h.p. Laurence Scott a.c. motors driving gas com-



enclosures of cast iron or heavy section steel, metal reinforced plastic external fans, gasketed terminal boxes, special paint finishes and special winding impregnation. There have also been attempts to fit throwers to the shaft at the drive end bearing with the object of excluding liquids from the bearing. The use of greases based on lithium soaps is now almost universal, and the author favours a policy of not carrying out any periodic regreasing of bearings. It is interesting to note that similar ideas on construction and operation prevail in the U.S.A. Two features incorporated in Westinghouse ventilated motors are illustrated by drawings. First, an air by-pass which avoids drawing contaminated air through the bearings and, secondly, a neoprene flinger to prevent liquid from entering the bearing if it should fall on the machine. A hole in the lower part of the motor frame would presumably achieve the same purpose as the air by-pass. In the U.S.A. also, sealed ball bearings with no provision for lubrication are much in favour. One design consists of interleaved metallic seals, one rotating while the other is fixed.

Again referring to American practice, the N.E.M.A. standards specify the leading dimensions of totally enclosed, ventilated and flameproof motors. Up to 25 h.p. every frame in these categories has the same horsepower output for a given speed. The temperature rise for flameproof and totally enclosed machines is 55°C and for ventilated machines 40°C. The ventilated machines are designed with a service factor permitting overloads. Since the insulating materials in use in North America are very similar to those employed in British motors, it is interesting to note that in the matter of temperature rise, American manufacturers are more conservative than those of Great Britain and Europe.

Performance of Squirrel Cage Machines

The performance of motors used in the chemical industry is often of vital importance. In general, motors in chemical works operate continuously, very often at full load, and hence a fractional improvement in both efficiency and power factor is a great asset. With power worth 1d per kWh an improvement of 1 per cent in the performance of a 20 h.p. motor will save £6 10s per year in energy. If the added efficiency costs £26 to obtain, there will still be a 20 per cent return on this additional

capital even after allowing 5 per cent for depreciation. An improvement in power factor is also obviously beneficial.

The other characteristics of an induction motor, which are of vital interest to the user, are starting torque, starting current and pull-out torque. Starting current and starting torque can both be controlled by the use of a wound rotor motor and an external resistor, but in the chemical industry the tendency has been to eliminate wound rotor induction motors on the score of reliability and cost. It is well known that in a squirrel cage motor, starting torque, starting current and pull-out torque are all influenced by the design of the rotor winding. Low starting current can be obtained by using high-reactance rotors, but this brings with it the disadvantage of a lower operating power factor when compared with a normal squirrel cage. High-resistance cages give good starting torque but decrease efficiency and increase slip. Doublecage rotors give good starting torque and good efficiency and there are other patented forms of rotor which give good starting torque and high efficiency. For cube law drives, e.g. fans and pumps, normal torque motors are adequate, but for conveyors and rotary dryers, motors with high starting torques are usually required. Some equipment manufacturers favour the use of fluid couplings to give a smooth take-up of the driven machine, but it should be noted that if fluid couplings are used, then high pullout torque is more desirable than a high starting torque, and usually the normal torque motor will fulfil these requirements. The torque speed characteristic of the induction motor often determines the size of motor which must be applied to a chemical works drive, e.g. rotary dryers in one factory with which the author is associated are driven by 100 h.p. squirrel cage motors, the size being determined purely by starting torque since the drive in service operates in the region of 60 h.p. To avoid poor power factors in such cases correction capacitors are essential.

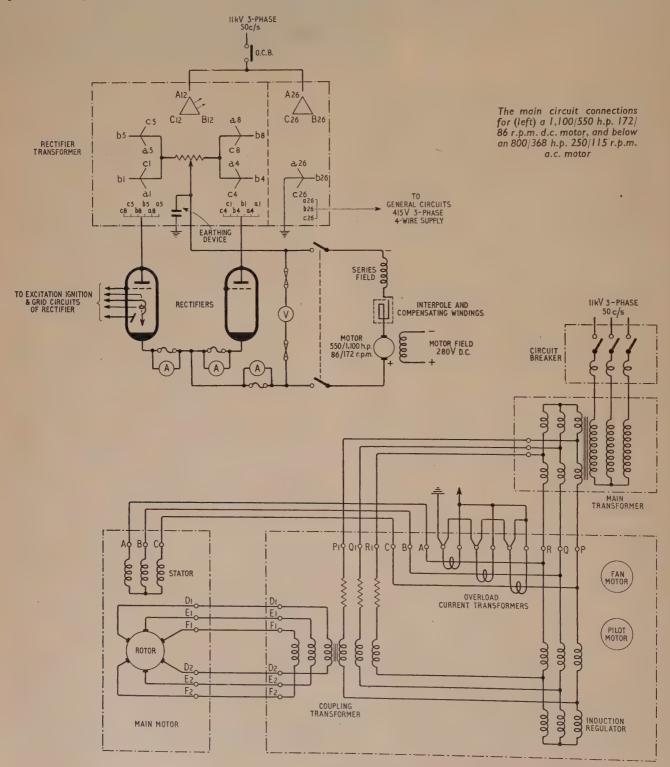
Special Hazards

Motors in the chemical industry often have to contend with unusual conditions. Exposure to chemicals can result in serious corrosion and the construction of the motor is important under these circumstances. As mentioned above, a number of manufacturers now produce so-called chemical works types which are designed to combat these corrosion conditions. Whereas

^{*} Chief Electrical Engineer, Alkali Division, Imperial Chemical Industries, Ltd.

the standard totally enclosed fan-cooled a.c. motor may have a pressed steel cover over the fan, the chemical works type will utilise a heavy section cast iron cover. If alkalis are present, then aluminium and aluminium alloys must be avoided. Generally speaking, cast iron construction is the most satisfactory all-round answer to corrosion.

In some chemical plants an explosion hazard exists due to the presence of inflammable gases, liquids and vapours. The need for special electrical equipment to deal with such conditions first arose in coal mining, but industrial practice has grown out of these coal mine techniques. The risk in mines is due to the presence of fire damp (methane), but motors are now designed for the wide variety of gases met with in industry. These gases are separated into four groups, the properties of those in each group being such that they are covered by the same type of electrical equipment, with the exception of Group IV for which no electrical equipment can be safely designed. The only Group I gas is methane, while Group II covers the bulk of industrial gases including the hydrocarbons. Group III covers ethylene and coal and coke oven gas, while Group IV contains such gases as acetylene, hydrogen and carbon disulphide. B.S. 229:1957 (flame-



proof enclosures for electrical apparatus) deals with the flameproof enclosure of electrical apparatus. The excluded gases in Group IV, particularly hydrogen, are often met with in the chemical industry, and some technique has to be devised for driving the machinery in such plants. Fortunately, hydrogen is an extremely light gas, and one approach is to use non-sparking electrical equipment (not necessarily flameproof), provided that the hydrogen is so well under control that its escape is normally unlikely, and that excellent ventilation is provided for dissipating any escaped hydrogen.

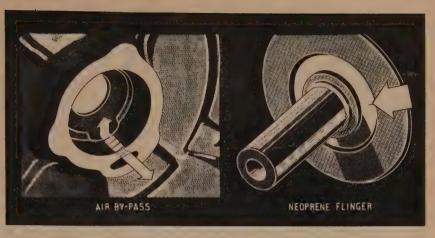
For motors for hazardous areas, flameproof construction is not the only safe approach. Suitable alternatives, which may be dictated by factors such as capital cost or non-availability of flameproof equipment, are pressurisation of totally enclosed motors coupled with an alarm or trip if pressurisation fails, or standard motors in a safe area driving equipment which is in the hazardous area, through, e.g. a gland in a gasproof wall.

Variable Speed Motors

There are many cases in the chemical industry where the use of a constant speed motor for a drive would result in a serious loss of efficiency. The financial implications of this efficiency loss have already been pointed out and it therefore becomes necessary to consider the use of a variable speed motor, capable of operating from a.c. supplies.

Variable speed motors fall into two groups, the first based upon the induction motor. At sub-synchronous speeds some device is required to return slip energy from the rotor to the supply and at super-synchronous speeds energy from the supply is to be injected into the rotor. The earliest motors of this type were shunt and series commutator motors. These were wound rotor induction motors with commutators instead of slip-rings. Three fixed brush arms per pole pair connected via a voltage regulator to the supply system enabled three-phase power to be fed into or drawn from the rotor winding. When power was fed into the rotor the speed was supersynchronous and when power was drawn from the rotor its speed was sub-synchronous.

The Schrage motor is a well-known variant of the a.c. commutator motor. In this machine power is fed into one rotor winding via slip-rings while a second rotor winding is connected to a commutator. On this commutator, two sets of brush arms, which can be moved relatively, are connected to the stator of the machine. The relative movement of the brushes determines whether energy is fed from the rotor winding to the stator or vice versa. (In this machine the usual roles of stator and rotor are reversed.) An improved form of fixed brush commutator motor, due to Dr. B. Schwarz, made its appearance 25 years ago. In this machine a subsidiary commutating winding in the rotor removed the limitations due to commutation present in previous machines, and they can now be built up to very large sizes. Various features are included in these motors which enable power factor to be kept high over the whole speed range.



An air by-pass (left) and a neoprene flinger on a Westinghouse motor bearing

The second group consists of d.c. machines supplied from rectifiers, often of the multi-anode mercury-arc type. For many applications speed control is obtained by varying the armature voltage of the motor while maintaining the field constant. In this way, very wide speed ranges at constant torque can be covered and hence this type of drive is often used for steel rolling mills as an alternative to Ward-Leonard arrangements. In the chemical industry the same arrangement is used for reciprocating compressors.

Five motors, which drive compressors dealing with an inflammable gas, are shown on page 217. The motors are in a well-ventilated room and the shafting between motors and compressors passes through the wall via gastight glands. Four of the motors are rated at 1,100/ 550 h.p., 172/86 r.p.m. and are d.c. machines fed from grid-controlled mercury-arc rectifiers. On starting the motors automatically run up to the base speed of 86 r.p.m. under grid control, and subsequent speed variation up to 172 r.p.m. is achieved in 33 steps by an on-load tap changer fitted to the rectifier transformer. Fine adjustment of the speed between the steps is achieved by grid control. This ensures that at any point in the normal operating speed range the minimum grid delay is used, and therefore the best possible power factor and waveform are obtained. The equipment is also arranged so that the motors can be run down to 40 r.p.m. under grid control.

The other two motors are rated at 800 h.p., 250 r.p.m. and are a.c. fixed brush commutator machines. The speed of these machines is continuously variable down to 115 r.p.m. under automatic control by air-cooled induction regulators. Each motor has an 11/3·3 kV double-wound transformer, the secondary of which is used to supply both the motor stator winding and the air-cooled induction regulator. The connections for both types of machines are shown in the diagram.

The successful development of semiconductor rectifiers utilising germanium or silicon opens up the possibility of using these devices to provide d.c. for individual motors. They can be used for constant voltage supplies for d.c. machines in which speed control is achieved by field weakening or, if wide speed ranges are required, variable voltage supplies can be obtained by control of the a.c. voltage applied to the rectifier. Saturable reactors, on-load tap-changing transformers, or induction regulators can be used as appropriate for this purpose.

U.K. Electrical Trade in First Half of 1960

THE export in June of electrical goods worth £18·1 million brought the total of the first half of this year to £120·7 million. This compares with goods worth £116·4 million exported in the first six months of 1959, a rise of 4 per cent. In contrast to total exports, exports of electrical machinery and apparatus showed no increase between the last quarter of 1959 and the first quarter of 1960. But whereas total exports fell by 3 per cent between the first

and second quarters, electrical exports remained virtually unchanged.

Exports of electric generators and motors showed an increase in the second quarter compared with the two previous quarters and the corresponding quarter a year earlier; there had been no increase between 1958 and 1959. Compared with a year earlier there were marked increases in shipments to Canada, Australia and

TABLE I.—ELECTRICAL EXPORTS

TABLE 1.—ELECTRICAL EXPORTS									
Class	Month of June 1960	Six mont Ju 1959	ths ended ne 1960	Class	Month of June 1960	Six mont Ju 1959			
	£	£	£ -		£	£	£		
Generating sets: Diesel driven, not exceeding 10 kW	116,107	610,377	802,513	Cookers	30,517 14,682	219,991	248,900 93,423		
10 kW to 65 kW	112,047	866,424	866,145	All other cooking appliances	37,080	196,277	253,350		
10 kW to 65 kW	95,805 260,828	992,162 1,835,522	713,767 966,652	Parts and accessories	88,205 11,025	521,322 144,685	548,521 138,093		
Over 200 kW	164,850	512,929	436,299	Space heating appliances	24,619	172,220	179,545		
Driven by spark ignition engines, hydraulic turbines or other prime movers	47,684	283,874	196,635	Other heating appliances	39,449 64,334	150,144 445,584	163,345 520,389		
Canadana				Other neating appliances Parts and accessories Irons Arc welding equipment, a.c. D.c Resistance welding Electric furnace plant Magnetos, ignition Sparking plugs Electric appliances for aircraft	71,942	400,251	431,050		
Not exceeding 200 kW	50,250 75,906	588,139 589,790	534,187 742,298	Arc welding equipment, a.c	45,255 53,654	251,325 330,720	276,256 338,864		
Parts	742,941	3,599,966	5,532,922	Resistance welding	51,416	221,922	224,394		
Motors, complete, other than railway, tramway and trolley-bus:				Magnetos, ignition	62,848 16,237	414,035 79,231	596,343 59,103		
Not eveneding 1 h n	195,457	930,414	1,417,385	Sparking plugs	199,850	919,514	1,342,973		
Over \(\frac{1}{3}\) h.p. but under I h.p	58,593 383,482	278,058 2,631,992	406,618 2,902,880	East of the last o	170,467 522,833 -	1,976,109 2,392,769	1,767,139 3,788,582		
I to 250 h.p	74,664	1,022,003	1,099,684	FOR CYCIES	44,527	238,210	303,464		
Railway, tramway and trolley-bus motors, complete, and parts of all motors	128,019	1,562,508	1,117,969	Signalling apparatus (incl. traffic signals) Instruments, commercial	135,159 185,702	1,369,428	713,553		
Starting and controlling gear for electric				House service meters (electrical) incl		1,062,593	1,170,196		
motors	254,619	2,052,713	1,583,080	Electro-medical apparatus (excl. deaf-aids	131,862	772,007	985,808		
	2,761,252	18,356,871	19,319,034	and X-ray apparatus and hatteries)	71,381	181,978	241,962		
Converting machinery	89,705	327,372	368,797	X-ray apparatus (excl. tubes and valves) Ceiling fans	67,281	258,910 579,308	292,958		
Mercury-arc rectifiers	48,760	328,563	269,002	Desk tans and parts of desk and cailing fance	31,888	95,610	528,629 151,399		
Transformers for lighting, heating and power (including coils):				Vacuum cleaners Floor polishers	130,673 52,887	835,427 445,148	900,293		
power (including coils): Not exceeding 7,500 kVA Over 7,500 kVA	418,735	3,061,340	3,064,534	Floor polishers Food mixers Hair clippers and dry shavers Other portable appliances	65,233	453,410	426,553 332,460		
Switchgear and switchboards (excl. tele-	169,029	2,561,609	1,565,465		73,801 39,430	223,920	534,363		
graph and telephone):				Parts Portable elec. tools, incl. parts*	222,596	131,140 679,281	1,091,529		
Switchgear up to 200 A, and not exceeding 660 V	503,686	2,144,110	2,409,922	Fortable elec. tools, incl. parts*	243,904	1,186,431	1,491,373		
660 V Other	953,772	7,471,410	6,922,538						
	2,183,687	15,894,404	14,600,258						
Batteries and/or cells, primary:	112.976		(4(070	Telegraph and telephone cables and wires:					
For radio	371,834	602,990 2,073,784	646,978 2,322,762	Submarine Other	45,769	3,119,788	1,313,699		
Other	29,303 48,014	217,358	242,128	Other Other descriptions:	302,639	2,559,497	2,402,594		
For lighting purposes	70,017	267,902	313,087	Enamel slees an art inade libres insulated	22,996 95,288	117,981	136,632		
Lamps:	89,390	529,188	614,239	Rubber insulated Rubber insulated Thermoplastic insulated Other	454,450	549,945 3,679,398	637,387 3,502,581		
Filament, exceeding 28 V Not exceeding 28 V		176,826	180,111	Thermoplastic insulated	251,938 255,643	3,679,398 1,767,251	1,618,330		
Not exceeding 28 V Arc lamps, complete* Discharge lamps, fluorescent tubes, etc.	16,874 95,953	98,421 565,135	44,105 540,203	Other	186,462	1,428,558	1,938,244 1,251,762		
Radio and television, etc., apparatus:	73,733	303,133	340,203		1,615,185	14,224,009	12,801,229		
Thyratrons, hot cathode mercury vapour									
and gas-filled rectifiers (excl. mercury- arc rectifiers), photo-electric cells (excl.									
photo-transistors), stabilising and cold cathode valves, magnetrons, klystrons	69,120	251,018	326,713	Accumulators					
Cathode varves, magnetrons, krystrons	48,601	511,304	336,936	Accumulators for motor vehicles	119,130	876,291	775,377		
Cathode ray tubes	380,249 99,538	2,539,461 163,435	2,274,245 310,294	For traction purposes For radio and other portable All other accumulators	11,155 53,552	133,281 182,600	101,824 213,361		
Broadcasting and television transmitters	51,082	606,291	321,782	All other accumulators Parts and accessories Electric wiring accessories Electrical ware (incl. insulators) of	27,096	354,005	149,625		
Communication and navigational and radar		9,257,514	9,061,886	Electric wiring accessories	66,989 210,902	489,892 1,171,752	524,563		
equipment	57,647	577,563	432,537	Electrical ware (incl. insulators) of ceramic materials, n.e.s.	99,839		1,312,046		
Battery (incl. complete vibrator sets) Other (incl. mains/battery and car)	61,438 36,380	340,395 183,869	499,965 195,584	materials, n.e.s Industrial electronic control equipment	197,933	644,771 682,407	747,058		
Radiograms	20,558	159,813	185,474	Cloth and tane			963,352		
Television receiving sets Public address equipment	53,297 83,986	389,590 578,568	368,580 585,810	Permanent magnets	104,146	319,847 852,531	430,163		
Other radio & television apparatus, n.e.s.	93,282	440,475	668,197		57,058	268,189	833,471 374,103		
Components and parts, n.e.s	3,742,339	4,656,583	6,845,388	Scientific electrical instruments (152,073	770,559	923,901		
T. L. and and and announced layings	630,913	4,528,973	22,413,391	and time switches)	397,123	1 000 744	·		
Telegraph and telephone installations Telephone instruments	154,155	607,783	3,820,456 922,912	All electric machinery, apparatus and appliances, n.e.s.:	377,123	1,980,764	2,461,155		
Parts	586,440	4,792,215	4,292,610	Machinery	25,125	107.04			
Line apparatus for long distance com- munication	212,213	1,239,555	1,439,274	Other	735,536	185,841 5,241,178	184,663 5,890,534		
	1,583,721	11,168,526	10,475.252	TOTAL	18,100,294				
1,583,721 11,168,526 10,475,252 18,100,294 116,437,278 120,715,194 * Figures for 1960 are not completely comparable with those for 1959									

^{*} Figures for 1960 are not completely comparable with those for 1959.

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE I)

Country			Month of June	Six months ended June			
					1960	1959	1960
Gibrale					£	£	£
Gibraltar Malta and Gozo	• • • •	• • • •	•••		13,842	64,211	108,298
Cyprus					38,285 35,611	253,304 386,515	276,663 426,853
Sierra Leone					24,195	213,246	207,863
Ghana Nigeria	•••			• • • •	174,884	1,251,645	1,557,934
Union of South.	Africa				475,122 1,205,355	2,826,353 9,964,003	3,112,189 8,334,523
Rhodesia and N	yasaland	d			484,159	3,724,721	3,935,066
Tanganyika Kenya	***		• • • •		48,896	250,499	311,466
Uganda					195,754 31,028	995,611 296,175	1,050,562 182,619
Mauritius					46,677	314,396	348,464
Aden Bahrain, Qatar a	nd Teu	oial Ca			57,128	322,525	336,149
Kuwait		on.	ates		98,776 195,934	640,455 1,158,739	666,675 1,333,847
India		***	***	***	1,224,507	9,599,352	8,027,162
Pakistan Singapore	***	***	•••	•••	295,877	1,628,467	1,924,688
Federation of M	alaya		***	***	205,796 178,288	1,572,472	1,240,432
Ceylon					138,409	1,230,755	1,060,150
British North B		• • • •	***		12,003 10,553	172,798 99,223	130,855 103,397
Hong Kong					388,090	2,497,570	2,346,082
Australia					1,784,418	8,460,005	10,795,580
New Zealand Fiji	***	• • • •	• • • •		837,072 13,646	4,759,007 182,671	5,082,162 134,358
Canada	***	***	***	***	1,000,604	5,799,064	7,656,850
Jamaica	• • • •	• • • •			135,865	856,915	1,002,991
Trinidad					42,561 116,112	215,404 729,732	267,541 971,651
British Guiana					57,877	411,832	405,539
Other Common					170,156	1,292,678	1,164,715
Irish Republic					365,760 128,196	1,694, 44 2 732,194	2, 4 29,551 787,498
Finland	***	***	***	***	149,719	584,096	1,086,777
Sweden Norway	***	***	***	***	480,671 324,490	2,997,348 1,069,450	3,186,173 1,518,053
Denmark	***	•••	•••	•••	188,604	1,319,516	1,544,789
Poland					198,689	373,387	562,421
Western Germa		***	***	***	531,396 671,836	3,167,362 3,836,231	2,881,550 3,439,485
Belgium	***	***			271,977	1,941,090	1,702,885
France		***		• • • •	355,486	1,538,107	1,971,645
Switzerland Portugal	***	***	***	•••	155,448 250,644	1,002,378 1,364,856	832,504 1,307,710
Spain					257,161	986,547	1,337,219
Italy					336,597	1,822,820 261,782	2,301,985 398,891
Austria Yugoslavia					67,036 129,170	436,991	691,253
Greece					71,253	686,888	575,600
Turkey					96,703 36,416	400,696 281,630	517,533 336,292
Belgian Congo Portuguese East	Africa				62,474	129,080	324,612
Egypt					69,886	1,069,143	641,330
Libya	ding Ta	ngiar)	• • • •		40,419	442,615	356,168 137,983
Morocco (exclusive Sudan					118,217	570,692	697,442
Syria					65,626	121,731 302,713	267,117 365,029
Lebanan					44,065 58,933	716,671	544,948
Jordan					52,809	502,599	471,088
Saudi Arabia					23,294	373,157	356,662 1,399,189
Iraq					205,412 182,265	1,882,973 1,883,302	1,276,046
Burma		***		***	52,810	574,109	301,607
Thailand	•••	•••		***	74,792 12,513	573,493 199,027	322,675 557,089
Indonesia China					137,042	272,540	745,203
Japan			***	***	34,817	358,213	295,816
United States o			***	***	808,301 42,154	8,286,278 218,879	7,442,892
Mexico					54,859	238,628	593,553
Colombia			***		29,500	191,302	287,694
Venezuela	•••	•••	• • • •		105,670	2,281,532	2,192,467 180,459
Peru Chile					27,458	667,505	488,936
Brazil					78,840	478,053 55,348	331,024 141,938
Uruguay Argentine Repu	hlic	• • • •	•••		29,992 493,565	55,348	2,496,950
Other foreign of	ountrie	e\$			340,169	2,279,349	2,214,940
						116,437,278	120,715,194
TOTAL	•••		•••	• • • •	18,100,294	1,0,137,270	120,770,77

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

TABLE 3.—300 NOES OF LELETINGS								
Country					Month of June 1960	Six months ended June 1959 1960		
Australia Canada Other Commo Irish Republic Sweden Denmark Western Germ Netherlands Belgium France Switzerland Italy United States C Other foreign	any	 	ries		£ 32,259 88,251 199,927 107,175 88,259 65,775 734,522 592,831 45,463 216,796 200,394 1,22,804 1,452,787 195,808	£ 204,903 453,749 734,596 489,198 303,447 3,397,849 2,881,733 274,961 843,009 857,325 496,100 5,074,824 1,269,231	f 199,833 679,477 1,118,302 656,461 576,987 398,327 4,577,880 3,548,346 262,966 1,011,048 911,478 767,522 8,697,746 1,224,422	
TOTAL		`		50+	4,143,051	17,951,903	24,630,795	

New Zealand. Radio equipment and valves exports also increased and were 18 per cent more than a year earlier. There were increased shipments to the main Commonwealth markets and the United States, but those to the two largest European customers, the Netherlands and West Germany, fell by a third.

Exports of transformers and switchgear, and telegraph and telephone equipment continued to fall, and were about 10 per cent less than in the first half of 1959. The sharp fall in wires and cables compared with a year earlier reflects mainly the heavy shipment of submarine cable to the United States in April, 1959. Exports of electric washers and dryers and parts, included in Table 4, increased by over 50 per cent.

Imports of electrical equipment in June were worth £4·1 million. This brought the total for the six months to £24·6 million, an increase of 22 per cent on the corresponding period of 1959. Between the first and second quarters of this year there was a slight fall in imports. Compared with a year earlier imports from the United States increased by 55 per cent, from West Germany by 35 per cent, and from the Netherlands and France by 25 per cent. The main items imported were radio equipment and valves, electrical equipment for motor vehicles, scientific instruments and motors.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of June 1960	Six months ended June 1959 1960		
Domestic electric washing machines, in- corporating centrifugal water extrac-	£	£	£	
tion Other, with or without wringers	251,510 152,353	2,031,468	{ 1,625,141 { 1,386,483	
Dryers (exported as separate units) Parts Electric locomotives (incl. battery types)	45,231 184,636 287,724	469,976 3,023,668	225,133 657,052 1,914,665	
Diesel locomotives with electric trans- mission	392,294	1,876,429	1,535,788	
Ferrous Non-ferrous Electric conduit tubes and cased tubes	113,428 29,840	492,200 126,641	758,000 143,003	
Electric carbons Electric lighting fittings and lanterns	95,396 106,374	359,487 596,672	545,787 647,260	
(excl. arc lamps, searchlights and cycle lamps) Electric fork-lift trucks	344,380 131,630	1,740,002 483,928	2,072,374 580,534	
Water and gas turbines, etc Steam turbines	193,469 11,245	1,865,621 563,586	2,690,424 926,517	

TABLE 5.-ELECTRICAL IMPORTS

Class	Month of June 1960	Six months ended June 1959 1960		
	£	£	£	
Generators, incl. parts	81,091	395,046	407,457	
Motors, incl. parts	189,864	715,059	1,068,487	
Convertors; transformers; rectifiers	157,016	559,437	958,711	
Switchgear and switchboards (not tele-	110.071			
graph and telephone)	112,071	546,019	879,756	
Cathode ray tubes, complete Other valves, complete	83,753	592,709	290,996	
0 . (1 3 1 1)	363,722 77,574	1,410,994 358.155	2,031,804	
Radio receiving sets, domestic or port-	77,377	330,133	647,218	
able	49,595	122,103	250,409	
Radio communication and navigational	17,570	122,103	250,107	
aids, complete	349,009	2,205,841	2;487,521	
All other radio and TV apparatus, parts			.,,	
and accessories	395,981	1,927,553	2,158,163	
Telegraphy and telephony apparatus	39,793	603,710	328,116	
Welding machinery	71,697	305,609	394,445	
Electrical cooking and heating apparatus	1.43.606	044.242	077.045	
(other than for motor vehicles)	143,686	844,343	977,945	
Magnetos, ignition, and electric appliances for aircraft, motor vehicles and cycles	326,105	973,534	1,751,788	
Electro-medical apparatus (incl. X-ray	320,103	773,334	1,/31,/00	
apparatus)	73,374	489,929	612,276	
Portable mechanical appliances, electric-	,	,	012,270	
ally operated, complete	124,486	631,702	702,503	
Parts	47,681	320,852	377,128	
Scientific electrical instruments (excl.				
telegraphic and telephonic)	145,272	834,545	1,010,043	
Machinery, apparatus and appliances,	1 211 201	4 114 7/3	7 204 202	
n.e.s	1,311,281	4,114,763	7,296,029	
TOTAL	4,143,051	17.951.903	24,630,795	
101/12	.,,	,,,	_ 1,000,775	

NEW ELECTRICAL EQUIPMENT

Sodium Floodlight

A floodlight now available from the Lamps and Lighting Department of the A.E.I. RADIO AND ELECTRONIC COMPONENTS DIVISION, 38-39, Upper Thames Street, London, E.C.4, is designed round the 3ft 200 W linear sodium lamp. Of the upward lighting type, it is fitted with a specular parabolic asymmetric reflector of electro - brightened aluminium. A toughened clear glass plate protects the reflector and is housed in a slide-on frame that can be removed easily for cleaning and relamping.

The lamp itself is mounted in a fixed bi-pin holder at one end which, with a "floating" lampholder and lamp clip at the other, holds the lamp



A.E.I. sodium floodlight

in the correct focal position. The cradle can accommodate a sheet steel control gear box if required. Both lantern and control box are fully treated against corrosion and are finished in battleship grey enamel. The reflector measures 45in wide by 25½in high by 6in deep and without a control gear box weighs 46 lb.

Hand-Lamp Transformers

Added to the range of all-insulated portable transformers manufactured by the STURDY ELECTRICAL Co., LTD., Hamsterley Colliery, Newcastle-upon-Tyne, is a hand-lamp unit available in two versions. The type "A" is arranged for connecting the hand-lamp cable through a nylon t.r.s. gland to terminals inside the case, and type "B" is fitted with one to four sockets and fused plugs of either the Reyrolle all-insulated glass fibre or Dorman & Smith insulated hard-rubber type. Both units are keyed to prevent a low voltage plug being inserted into a higher voltage socket. They are continuously rated at 240 VA and are available with either 25 or 50 V output from a standard single-phase 50 c/s



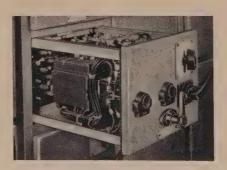
Sturdy type "A" hand-lamp transformer

supply. Other ratings are available to order.

An earth screen between windings and a centre-tapped secondary are provided. The cases are manufactured from resin-bonded glass fibre material with a harness type carrying handle, and for orders of six or more units they can be supplied in cases pigmented to any required colour. The use of the glass fibre enclosure, insulated plugs and sockets, nylon t.r.s. primary glands and nylon screws for lid fixing eliminates "live" exterior metal parts.

Multi-Tier Motor Starter

An eight-tier motor starter enclosure with a withdrawable plug-in chassis has been announced by the Belmos Co., Ltd., Bellshill, Lanarkshire. Occupying a floor area of 1.3 sq ft, the enclosure accommodates eight direct-on-line contactor starters suitable for



Chassis partially withdrawn from a Belmos eight-tier starter

the control of motors up to $7\frac{1}{2}$ h.p. at 440 V. The withdrawable chassis contains the contactor and thermally operated overload relay, h.r.c. fuses, and stalled-current-breaking isolating switch, and has push-buttons mounted on the front cover. Additional features which can be fitted include an ammeter or indicating lamps,

local/remote selector switch, low voltage control by buswires, and sequence interlock between starters. The starters are designed in accordance with B.S. 587: 1957 and are rated for frequent duty, i.e. up to 40 operations per hour.

The electrical connections between the chassis and the housing are made by blade and clip contacts for the main incoming circuit and spring-loaded butt contacts for the main and auxiliary outgoing circuits, with an insulating board shielding the live fixed contacts at the back of the cubicle. The outgoing wiring from each starter enters a vertical trunking inside the back of the cubicle and runs to the outgoing terminal chamber at either the top or the bottom of the board.

Automatic Beryllium Monitor

The concentration of beryllium in the atmosphere where people are employed should not exceed two millionths of a gram per cubic metre. The results produced by an automatic beryllium monitor, designed and developed by Messrs. M. S. W. Webb, R. J. Webb and P. C. Wildy, of the United Kingdom Atomic Energy Authority's Woolwich Outstation, and manufactured and marketed by WINSTON ELECTRONICS, LTD., Shepperton, Middlesex, are quantitative over the range 1-75 millionths of a gram per cubic metre and they are not affected by the chemical form or size of particles normally present in atmospheric dust.

The air to be sampled is drawn through a chamber in which any beryllium present is optically excited as it passes through a triggered a.c. arc. The ultra-violet radiations from this source are resolved into their components by a spectrograph and the intensity of the beryllium doublet at 3,130 Å, which is proportional to the concentration of beryllium present in the air being monitored, is measured photo-electrically. The ratio of the intensity of this doublet to the intensity of the adjacent background is then recorded.

The apparatus is fully automatic and operates on a predetermined cycle in which it is first calibrated and then records a series of results, at one-minute intervals. Calibration is achieved by using a spark discharge between a beryllium copper electrode and a copper counter electrode producing an aerosol containing a uniform concentration of beryllium at a constant

rate, air for this being drawn through special filters. The equipment operates from a 230-240 V, 40 to 60 c/s, or IIO-I30 V, 40 to 60 c/s supply and has a consumption of 2.5 kW.

Counters

A range of counters has recently been introduced by the Telephone Manufacturing Co., Ltd., Hollingsworth Works, Martell Road, London, S.E.21. These "Elmeg" counters, which can be used on supplies up to 250 V, are available in print-out and read-out form with uni- or bi-directional motions and operating speeds of up to 40 impulses per second. They can be reset to zero by electrical, mechanical or electro-mechanical



T.M.C. single decade print-out counter

methods. Some have auxiliary contacts which operate on each revolution of a numbered wheel. The range includes a single decade print-out counter of slim dimensions with self-homing reset and a six digit bi-directional read-out counter with push-button reset and a variety of contacts to give a circuit closure at zero.

Cyclic Thermostat

The type CY thermostat announced by Process Control Gear, Ltd., Lattimore Road, St. Albans, Herts., is designed to give a variable temperature cycle over a range of o to 90°F with a temperature band between 10° minimum and 30° maximum. Primarily designed for use in greenhouse control, it comprises an air stem thermostat with a 24in long by $\frac{9}{16}$ in o.d. thin gauge stem tube attached to an enclosed switch head containing the time clock setting mechanism and terminal block. A 3/4 in conduit entry is provided. The switch capacity is 15 A at 250 V a.c.

Illuminated Ceiling

A new low-cost illuminated ceiling announced by LUMENATED CEILINGS, LTD., Alliance House, Caxton Street, London, S.W.I, makes it economic for

this type of lighting to be installed in a variety of industrial situations, while the attractive appearance favours its use in public areas such as shops, hotels and restaurants.

Known as the "Lumenated Westminster" ceiling, the new lighting system can be supplied and installed for approximately 5s 6d per sq ft, excluding lights. It is based on 3ft square diffusing panels supported by a lightweight aluminium track suspended from the structural ceiling. Daylight from laylights, or artificial lighting from lamps in the plenum, is diffused through the panels so that the space below is evenly illuminated, without causing glare or shadows.

The diffusing medium used in the panels is a translucent sheet of flexible p.v.c., and it can be supplied in a range of qualities extending from high-efficiency daylight to non-glare, and in a variety of colours.

The complete ceiling weighs less than 7 oz per sq ft and since all the metal parts are of aluminium no maintenance or painting is required.

Switch-Fuse Unit Range Extended

The size of transformer which could be protected by switch-fuse units in the type HF11 range manufactured by the BRUSH ELECTRICAL ENGINEERING Co., LTD., Loughborough, has been limited to about 500 kVA at 11 kV by the current ratings of fuse-links available in this country. Recently, however, a range of powder-filled fuse-links for use in air has been produced by Line Equipment, Ltd., of Bridgend, Glam., including ratings of up to 90 A at 11 kV and 125 A at 6.6 kV.

These fuse-links, which have been tested to B.S. 2962, are of the current limiting pattern and consist of pure



Line Equipment 90 A I I kV fuses in a Brush switch-fuse unit

silver wire or strip (depending on the current rating) wound helically on carriers of ceramic material, surrounded by pure silica sand and contained in a ceramic barrel having copper end ferrules. A pilot fuse fed through the centre operates a striker pin which, in turn, actuates the switch tripping mechanism. The Brush switch-fuse unit has an air-insulated fuse chamber and, with the new fuses, can be used for protecting and controlling transformers of up to 1,500 kVA rating at 11 kV.

Oscilloscope

The model 33a oscilloscope announced by Taylor Electrical Instruments, Ltd., Montrose Avenue, Slough, is designed for laboratory use and for television and radio servicing. A hard-time-base having good synchronisation characteristics is provided, covering the range of frequencies from 2 c/s to 100 kc/s, and it can be operated either free running or triggered. Horizontal and vertical amplifiers with push-pull output are



Taylor Electrical Instruments oscilloscope

provided. The latter is of high gain and has a frequency range extending from a few cycles per second to 60 Mc/s. Both amplifiers have outputs corresponding to several screen diameters. All types of waveforms, including pulse types of short duration, can be examined and extended for detailed study. A feature of the oscilloscope is the stabilised power supply which ensures a steady trace under all conditions.

High Temperature Sleeving

For high temperature processing or other applications Permanoid, Ltd., New Islington, Manchester, 4, have introduced a sleeving manufactured to type I, class 105T, B.S. 2848:57. The sleeving has viscose silk internal reinforcement and a plasticised p.v.c. outer coating. It is suitable for con-

tinuous operating temperatures up to 105°C and is available in eleven colours (including black and white) in bore diameters from 0.5 to 5 mm. The electrical properties include insulation resistance not less than 1,000 MO and a breakdown voltage of 3,000 V when tested in accordance with B.S. 2848:57.

Electrical Tapes

Three more tapes have been added to the range of electrical pressure sensitive products manufactured by PERMACEL TAPES, LTD., Slough, Bucks. Tape P.10 is constructed from a plasticised p.v.c. coated with a nonstaining rubber based pressure sensitive adhesive suitable for use over a wide temperature range. The total thickness of the tape is 0.0065in with a voltage breakdown of 9,500 V. The roll length is 25 yd and the tape is available in widths from 1/4 in to 6in.

Tape P.46 consists of treated varnish sized glass cloth having a count of 60×50 threads/sq in, spread with a white rubber based pressure sensitive heat curing adhesive free from corrosive agents. The total tape thickness is 0.0075in and it has a voltage breakdown of 2,700 V. For this tape the roll length is 60 yd and the widths are again from $\frac{1}{4}$ in to 6in.

The cotton cloth tape P.48 is constructed from varnish sized specially treated unbleached cloth having a count of 74×74 threads/sq in, and spread with a white rubber based pressure sensitive heat curing adhesive free from corrosive agents. The total thickness of this tape is o-013in with a voltage breakdown of 1,500 V. The tape is available in rolls having the same sizes as tape P.46.

Miniature Potentiometric Recorder

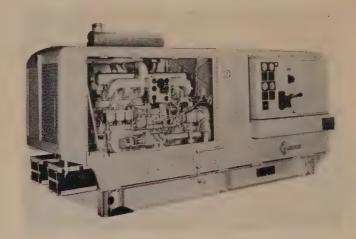
The miniature potentiometric recorder, MR 1035, produced by FIRTH CLEVELAND INSTRUMENTS, LTD., Stornoway House, Cleveland Row, London, S.W.1, requires a panel space only $7\frac{7}{8}$ in wide by $5\frac{1}{2}$ in high. It presents a continuous line pen record on a 3in wide calibrated chart whose life is one month at one inch per hour. Six chart speeds are available. There are six standard ranges for minimum span sensitivity: 1, 5, 10, 20, 50 or 100 mV. The recorder is accurate to ±0.5 per cent of full span, or ±10 mV, and its sensitivity is 0.1 per cent or 5 mV, whichever is the greater, and its stability is within 0.3 per cent.

Facilities in the form of a driven output shaft can be provided for operating a pneumatic or electronic controller. Automatic cold junction compensation is available for all models when used with thermocouples. In the event of a thermocouple becoming open-circuited, the pen goes off scale towards the maximum indication. With limit switches fitted, this facility can be arranged to operate an alarm or control function.

Polyester Capacitors

A series of low priced polyester capacitors intended as an alternative to paper dielectric types has recently been produced by Suflex, Ltd., Bilton House, 54-58, Uxbridge Road, Ealing, London, W.5. The range covers from oor to oo5 \(\rho F \) with a \(\pm 20 \) per cent tolerance and operating at 350 V d.c. They are 28 mm long and the diameters vary from 7 to 12 mm. The maximum operating temperature is 100°C and the insulation resistance is greater than 100,000 M Ω . Sealing is adequate to ensure a less than 5 per cent capacity change after severe climatic tests. The power factor of the units is less than o.or at 25°C.

Mains Failure Generating Sets



Meadows diesel-driven generating set for automatic operation

MAINS failure generating sets, designed to operate in all climates, are being produced for the Air Ministry by Henry Meadows, Ltd., of Wolverhampton. These 135 kW sets come into operation automatically on mains failure to give a full load within ten seconds of starting at temperatures down to -15° C. Each generator is driven by a 6-cylinder turbo-charged diesel engine having a maximum output of 218 b.h.p. at 1,500 r.p.m. The engine unit is flexibly coupled to a twobearing alternator, producing 135 kW at 0.8 power factor, and 415/240 V, 50 c/s having $\pm 2\frac{1}{2}$ per cent voltage regulation. The set output is controlled by a miniature panel.

CATALOGUES AND LISTS

COUPLINGS.—Pamphlet giving details of "Quadriflex" four-way flexible couplings.—
R. & J. Dick, Ltd., Greenhead Works, Glasgow

INSULATORS.—Illustrated 36-page publication (25) entitled "Making Porcelain Insulators" and a catalogue (22) covering isolator and busbar insulator stacks for 132 kV to 330 kV.—Doulton Industrial Porcelains,

Leaflet describing glass fibre stay wire insulators for overhead line equipment.—Permali, Ltd., Gloucester.

LIGHTING FITTINGS.—Leaflet on the "Super Slim Popular Pack" fluorescent fittings.—Ekco-Ensign Electric, Ltd., 45, Essex Street, Strand, London, W.C.2.
Illustrated leaflet giving particulars of the "All-Angle" swivel joint for lighting fittings.—C. M. Churchouse, Ltd., Clarendon Works, Clarendon Cross, London, W.11.
Illustrated 32-page catalogue (5600) cover-

Illustrated 32-page catalogue (5600) coverg the "Holophane" range of industrial lighting equipment.—Holophane, Ltd., Elverton Street, London, S.W.I.

Brochure illustrated in colour and showing

new designs of decorative lighting fittings and a leaflet dealing with the "Controlite" clip-on reflector.—Courtney, Pope (Electrical), Ltd., Amhurst Park Works, Tottenham, London, N.15.

RESISTORS.—Catalogue listing particulars and dimensions of "Ceramite" wirewound ceramic embedded resistors.—Zenith Electric Co., Ltd., London, N.W.2.

SATURABLE REACTOR. — Pamphlet dealing with saturable reactors/transductors.

Haddon Transformers, Ltd., Victoria Park
Industrial Estate, Field End Road, Ruislip, Middlesex.

SOUND SYSTEMS.—Booklet (1380/CS) giving particulars of the company's sound reproduction systems for industrial and commercial use.—Communication Systems, Ltd., Norfolk House, Norfolk Street, London,

STANDARD CELLS.—Leaflet (256/3) giving particulars of Weston saturated type standard cells.—Cambridge Instrument Co., Ltd., 13, Grosvenor Place, London, S.W.1.

INDUSTRY AND THE HOUSE

Debate on European Trade

By AUSTEN ALBU, M.P., B.Sc., A.M.I.Mech.E., M.I.P.E.

WHEN the House of Commons finally got around to discussing the problem posed by the development of the European Economic Community it did so with little sense of urgency and in a thin House. The truth is that, although a number of members on both sides would be willing to see the Government offer to join the Community by signing the Rome Treaty which established it, neither the Government nor the Opposition leaders are yet prepared for such a step.

On this occasion, however, Mr. Selwyn Lloyd, making his last speech as Foreign Secretary, seemed more aware of the need for action than previous Government spokesmen, but Mr. Harold Wilson, after weighing the pros and

cons, came down for standing pat.

Mr. Lloyd started by making it clear that we in Britain regarded ourselves as part of Europe. He said that from the beginning we had welcomed the formation of the Six as a step towards European unity. There were two problems about further steps towards this. The first was the fact that acceptance of the Common Tariff of the Six would be the end of the principle of Commonwealth dutyfree entry of goods and commodities. The second problem was agriculture, because in the Six the consumer paid the cost of farm support directly through the price of food in the shop, whereas ours was a system under which the cost was borne by the taxpayer and as a result we had cheaper food than most countries in the world. Mr. Lloyd also referred to the supra-national institutions of the Six and said that if a higher Parliament were to control the whole social and economic life of the people we would have to think very carefully what our position would be.

Trade and Tariff Policy

In the immediate future, the Foreign Secretary suggested, we should develop in every way our trade with the European Free Trade Association. Next we should try to reduce as far as possible discrimination between the two groups and help to bring about, through the General Agreement on Tariffs and Trade, a reduction in the level of world tariffs. Most important of all we should do all in our power to strengthen the political will of Western Europe towards achieving satisfactory and suitable arrangements. He welcomed the developing pressure of Parliamentary opinion in Europe for an agreement and said that Ministers were in close and frequent contact with their colleagues in the various Governments concerned. He would not exclude participation in common institutions.

Mr. Wilson said that the economic division of Europe was a fact and we must start from there and not moon about wishing things were different. The seventeen-nation Free Trade Area, as originally conceived, was dead. Europe was looking to Britain for a lead and the Government seemed to be in a rut. The

real dangers of the prospective division of Europe were not so much from a diversion of trade as of investment. He thought it was possible to exaggerate the economic consequences. Something like 14 per cent of our exports went to the Six. If, as a result of tariff discrimination, they were cut by 20 per cent, that would only mean a loss to our total exports of between 3 and 4 per cent. That could be made up in the markets of the Commonwealth and the United States.

Common Market Investment

Mr. Wilson emphasised the fact that the Six were outstripping us in the volume and purposiveness of their investment and pointed out the magnetic attraction which the Community presented to new American investment. He did not feel that the system of planned agriculture to which the Six were committed would have serious effects on British agriculture. On the question of the harmonisation of social policies, which had worried the trade unions, he thought it was no longer true that there was a danger of competition from countries with lower standards as a number of countries in the Six were now outstripping us in the provisions they made for the social services.

Mr. Wilson thought that the strongest arguments against joining the Six were political. He doubted whether there existed in certain quarters of the Six the same desire to ease tension between East and West as existed in this country. If we were to join the Six we should not have the same freedom in seeking to build a bridge between the Soviet Union and the United States or between the United States and China, a theme which was elaborated by Mr. Dennis Healey in winding up for the Opposition. He also doubted whether as a member of the Six we should have the same ability to give a lead to the newer members of the Commonwealth. His own proposals differed little from those put forward by Mr. Lloyd. He made one new suggestion, however, that the Seven should invite the Community, as as economic unit, to join the E.F.T.A.

Sir Anthony Hurd, who speaks for the agricultural interest, after examining the difficulties, said that he did not worry about the prospect of a managed agricultural market in Europe and the possibility of maintaining our system of price support in balance with the protective measures which the other countries in Europe would want to retain. We should come to some arrangement which would balance supplies and prices on a basis that would not leave us out of line with the other countries of Western Europe. Mr. Ronald Russell, Conservative, wanted a relaxation of the rigid restrictions imposed by G.A.T.T. so that we could find a flexible system of dovetailing our Commonwealth preference system with the Common Market and Free Trade Area.

A triumvirate of Labour M.P.s from Sheffield, Mr.

Hynd, Mr. Mulley and Mr. Winterbottom, made a strong plea for Britain to offer to enter the Community. They pointed out that the problem was much more a political than an economic one. Mr. Mulley doubted whether the President of the Board of Trade appreciated the force of the political idea of European unity. He emphasised the dynamic expansion to be found today in Europe. We should initially try to become associate members of the Community, accepting the political and economic integration envisaged in the Treaty of Rome. Mr. Hynd said that if we did not go into the Community the Commonwealth would be one of the heavy losers. He believed that the only proposition which would have any effect at all in the new Community was for us now to make a clear declaration that we were ourselves prepared to join it as a full member. Mr. Winterbottom thought that the suggestion that the Six should join the Free Trade Association was doomed to failure. He had found in Europe an earnest desire to see Britain in the Community and playing her part in the progressive integration of Europe.

Mr. Turton, a Conservative Privy Councillor, feared the effect of our preoccupation with Europe on the countries of Asia and Africa. Our partners—the Commonwealth—must get advantage out of an expanding Western Europe. There was no reason why the Common Market preferential area could not be married to our Commonwealth preferential area. In reply to this your correspondent pointed out that the leaders of the Community had a strong feeling of the responsibilities of Europe to the under-developed countries. Mr. Maurice Macmillan thought that we should wait and use the period of delay to build up the strength and unity of the Free Trade Association so as to demonstrate that it could work without those provisions of the Rome Treaty which we found unacceptable. We could also co-operate with all European countries in O.E.E.C. in planning aid for under-developed countries. He accepted that we could not join the Common Market as it existed, but asked if the Government could not indicate whether or not we were willing to join some form of Common Market.

The Liberals, none of whose members was called by the Speaker in the debate, divided the House to express their dissatisfaction with the Government's motion. They were joined in the Lobby by one Labour member.

B.E.A.M.A. Statement on International Standards

THE need for the United Kingdom to play an active part in the work of aligning electrical engineering standards in Western European countries is emphasised in a policy statement issued by the Council of the British Electrical and Allied Manufacturers' Association.

This points out that during the last two years the countries of the European Economic Community have been working to achieve common standards, and at a meeting in Zürich of the Western European National Standards organisations, the six Gommon Market countries expressed their willingness to collaborate with the seven E.F.T.A. countries. The 13 countries will now work as equal partners towards the alignment of Western European standards and the maximum development of

international standards through the International Standards Organisation (I.S.O.), the International Electro-Technical Commission (I.E.C.) and the International Commission on Rules for the Approval of Electrical Equipment (C.E.E.).

The B.E.A.M.A. Council "considers it essential that the United Kingdom should play an active part in such developments and strongly supports any such efforts towards a greater degree of harmonisation in international standards and practices than has existed previously."

To this end, the Council believes that "the industry's policy should be governed by the will to reach agreement on such standards and the willingness to effect reasonable compromise with the other participating countries, as for instance on performance and dimensions, and the Council therefore desires that B.E.A.M.A. representatives of the industry on international standards committees and the like should be guided by such principles."

Rotary Machines for Vehicles

A NEW edition of B.S. 173 is now available under the title "Rotating Electrical Machines for use on Road and Rail Vehicles." It reflects progress in the industry during the past 19 years and covers the electrical performance of rotating electrical machines forming part of the equipment of electrically-propelled rail and road vehicles, including those in use in mines, whether powered from an external supply or from an internal source.

In preparing this standard, account has been taken of a number of publications of the International Electrotechnical Commission, including No. 48 (1955) "Rules for Electric Traction Motors," No. 101 (1958) "Rules for Auxiliary Machines on Motor Vehicles" and No. 102 (1958) "Rules for the Electric Transmission of Vehicles with Diesel Engines." The standard does not relate to electric motors for battery-operated vehicles and similar industrial trucks; these continue to be dealt with in B.S. 1727.

Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 10s.

MODERNISATION OF GLEEP

AFTER nearly 13 years' operation at Harwell GLEEP, Western Europe's first reactor, has been extensively overhauled. This modernisation will increase the safety and efficiency of the reactor and enable it to operate for many more years.

GLEEP first went critical on 15th August, 1947, and since then it has operated on the original loading of fuel and without major modifications. Five months ago the reactor was shut down and the 33 tons of fuel in the form of canned uranium oxide pellets and bare uranium bars were unloaded. The latter were some of the first examples of uranium fabrications in this country and had deteriorated with time. For the sake of safety during unloading the mechanism for pushing out the fuel employed a blanket of argon to eliminate any possibility of fire, while powerful vacuum cleaners removed particulate matter and thus reduced friction. The fuel has now been sent to Windscale for reprocessing and the reactor has been recharged with natural uranium fuel elements canned in aluminium.

During the shut-down of GLEEP the reactor instrumentation was completely renewed. The two principal control rooms, one for the reactor and one for the experimental facilities, have now been combined.

PARLIAMENTARY REPORT

Controlling Expenditure

Steps to strengthen the control which the House of Commons exercises over expenditure by the Government and nationalised industries were announced by Mr. R. A. Butler. The changes, which will be put into effect next Session, result from pressure from Conservative back-benchers, and in particular Mr. Nabarro, for greater and earlier opportunities for debating estimates of expenditure in the public sector.

The new arrangements involve increasing the membership of the Select Committee on Estimates so that an additional sub-committee can formed to examine and report briefly upon the spring Supplementary Estimates as an early and urgent task. The Select Committee, in addition to its detailed examination of selected estimates, will be asked to examine the principal variations between the Estimates before the House and those of the preceding year. Their report would provide the House with a basis upon which to debate Government expenditure in the autumn. Extra time will be provided for debating the reports from the Estimates Committee and the Public Accounts Committee, and a White Paper on the investment programmes in the public sector including the nationalised industries will be published in the autumn. The proposals were welcomed by Mr. Harold Wilson as being "on the right

Scientific Instrument Exports

A suggestion that Britain's export trade in scientific instruments might be damaged through failure to keep up with developments in importing countries was refuted by the President of the Board of Trade, Mr. Maudling. He told Mr. C. Osborne, who had also suggested that the Scientific Instrument Manufacturers of Great Britain should make a report on their recent Moscow exhibition, that the United Kingdom exports of scientific instruments had risen steadily in recent years. The Moscow exhibition was a great success, he said, and the Russians had shown interest in buying many types of British equipment. Between 90 and 95 per cent of the equipment shown in the exhibition had been sold.

Thermonuclear Research

Questioned about the possibilities and costs of the Zeta I and Zeta II experiments, Sir David Eccles said although it was uncertain at this stage whether thermonuclear research would lead to economical power production, the rewards of success would be so great that the Government considered the present programme fully justified. Capital and operating expenditure on Zeta I and its modifications up to June last had totalled about £2,600,000, including £460,000 for design studies and development work for Zeta II and other future systems. No capital expenditure had been incurred on Zeta II because the design studies and development work, together with experience on Zeta I, had shown the necessity for an Intermediate Current Stability Experiment for plasma stability studies. This was now in active preparation.

Satellites and Long Distance Communications

Speaking on the use of satellites for long distance communications, the Postmaster General (Mr. Bevins) said "I believe that technically it is possible, but we have a great deal of further

work to do on the financial and other implications." He added that there would be no delay in coming to a decision on whether to go ahead with space satellites for this purpose, but said that submarine communications would still be required.

Nuclear Installation Regulations

The Nuclear Installations Regulations, 1960, laid before Parliament last week, prescribe certain classes of installations for the purposes of the Nuclear Installations (Licensing and Insurance) Act, 1959. When the Regulations come into force on 22nd August, such installations will need to be licensed and the other provisions of the Act, including cover for the licensee's liability by insurance or other approved means, will apply to them. The Regulations extend the provisions of the Act, at present only applicable to nuclear reactors, to certain other classes of installations in the atomic energy field where a nuclear hazard could arise.

Actions Against E.T.U.

In the High Court last week the Electrical Trades Union, Mr. F. Foulkes (president), Mr. F. Haxell (general secretary) and Mr. R. G. McLennan (assistant general secretary) submitted to interim injunctions restraining them from continuing to hold the election for the post of assistant general secretary and from publishing the result or the number of yotes cast for each candidate.

The injunctions were claimed by Mr. F. J. Chapple, a candidate for the post, who alleged that votes were improperly cast in the Woolston (Southampton) Branch and London Station Engineers No. 5 (Stepney) Branch. Mr. W. Wells, Q.C., said that the motion had nothing to do with proceedings two months ago concerning Mr. Chapple's election address. The present proceedings were begun by writ on 11th July. He referred to the results of a check made on votes cast in the two branches.

Mr. N. Lawson, Q.C., for the respondents, said that the allegations against them were denied but it was conceded that there was a position requiring investigation. Having regard to difficulties under the rules about the time limit for scrutiny they were prepared

to submit to the injunctions until trial of the action or further order.

Mr. Justice Cross, in the High Court on 29th July, refused to grant an interim injunction restoring to Mr. Leslie Cannon, a member of the Electrical Trades Union, the right to hold office in the Union. The Judge said that the case involved constitution of the rules of the Union, which he could not decide on an interim application. He thanked Mr. Cannon, who conducted his own case, for making "a rather difficult case very clear to me indeed."

Copper Data

The latest edition of the Copper Development Association's publication "Copper Data" has been revised to conform in size and layout with the standardised format adopted for the Association's other technical publications. It deals with the properties, treatment and working of copper and enumerates the various commercial grades and their applications. It also lists the other publications which, like "Copper Data," are available free of charge from the Copper Development Association, 55, South Audley Street, London, W.I.

INDUSTRIAL NEWS

Steelworks Automation Unit

An important step towards meeting rapidly increasing requirements for automation in the steel and allied industries has been taken by Associated Electrical Industries, Ltd., and Davy-United, Ltd. These two companies have announced the formation of a jointly-financed Steelworks Automation Unit to apply new automatic control techniques to the processing both of steel and of non-ferrous metals. Automation projects will include the combination of advanced servocontrols with computers to ensure optimum performance of rolling mills and associated plant. The A.E.I./ Davy-United Steelworks Automation Unit has its headquarters at Mill Road, Rugby, with representatives both at Davy-United, Ltd., Sheffield, and at the A.E.I. Heavy Plant Division,

Chandeliers for Siamese Palace

The General Electric Co., Ltd., has received an order for three giant, real crystal and gold-plated, chandeliers for the Grand Palace, Bangkok. They will be 11ft 6in high, without supporting straps, and over 6½ft in diameter, and each will incorporate 7,800 crystal drops, three gold-plated metalwork bands and forty-five three-light candelabra arms. Other items chosen for the Palace include sixty-four Georgian period gold-plated chandeliers and matching brackets to be made at the G.E.C. Magnet Works, Birmingham, and 121 floodlights.

Radar Simulator Contracts

Solartron Radar Simulators, Ltd., a subsidiary of the Solartron Electronic Group, Ltd., has been awarded contracts by the Swedish Government for the supply of new radar simulating systems. The total value is approximately £200,000, and the equipment is scheduled for delivery within eighteen months.

Cookers at Boys' and Girls' Exhibition

The Modern Cooking Promotional Committee is sponsoring a haven for parents at the 1960 Boys' and Girls' Exhibition, which will be held at Olympia from 16th to 27th August. At "Cooker Corner" mothers and fathers will be able to relax in comfort or inspect a wide range of the newest electric cookers made by the member companies of the Committee: Belling, Carron, Creda, English Electric, Falco, General Electric, Jackson, Revo and

Tricity. Elsewhere on the stand boys and girls can enter the "Spot the Cooker" competition, currently running in the children's publications Eagle and Girl. Contestants are being asked to fit the makers' names to nine cookers illustrated on the entry form, then place in order of importance a number of the advantages of electric cooking.

Irish Synthetic Rubber Works

The Maydown Works, Northern Ireland, of the Du Pont Company (United Kingdom), Ltd., built to produce neoprene synthetic rubber, was officially opened on 26th July by Lord Wakehurst, Governor of Northern Ireland. Mr. W. S. Carpenter, Jr., chairman of the board of directors of E.I. du Pont de Nemours & Co., of Wilmington, Delaware, U.S.A., Mr. W. H. McCoy, managing director of the United Kingdom subsidiary, and Mr. J. C. Weyrich, works general manager, also participated in the ceremony which was attended by over 150 guests from Northern Ireland and other parts of the United Kingdom, Europe and the United States.

New Ekco Electronics Factory

Work has started in the partly completed Ekco Electronics Works, Ashingdon Road, Rochford, Essex. Production of the specialised equipment marketed by Ekco Electronics, Ltd., has been transferred from Ekco Works, Southend-on-Sea, and the Electronics Installation and Service Department has moved into the new factory. In the near future, production of radar and associated equipment will be transferred from Malmesbury (Wilts) to the new works, thus centralising the whole electronics produc-

tion enterprise at Rochford. The total area of the first stage of the factory is about 44,500 sq ft and work is already in progress on the next stage on the 13-acre site.

Relay Television for Scotland

General Piped Television, Ltd., a company formed earlier this year by J. F. Thomasson & Co., merchant bankers, and in which a controlling interest has been acquired by Pillar Holdings, Ltd., is extending to Scotland the television service it provides to viewers' homes by a relay system. For this purpose the company has acquired a controlling interest in Aerial Developments (Glasgow), Ltd., and that company's name has been changed to General Piped Television (Scotland), Ltd. The General Electric Co., Ltd., which has a minority interest in General Piped Television, Ltd., will provide full technical assistance for the signal distribution.

Semiconductor Rectifier Selector

A selector for semiconductor rectifiers in the form of two discs which rotate in relation to one another has been produced by the Semiconductor Division of the General Electric Co., Ltd. The discs are rotated until the desired value of output current, which can range from 200 mA up to 100 A, on the one disc is aligned with the d.c. output voltage, up to 400 V, on the other. The rectifier code number for six circuits-single-phase half-wave, bi-phase, single-phase bridge, threephase half-wave, three-phase bridge and double star-appear in windows in the top disc. The circuit chosen depends upon the tolerable ripple, transformer efficiency and convenience. The rectifiers given are in

Part of the new Rochford Works of Ekco Electronics, Ltd.



general for operation at 30°C ambient and the values are calculated on the upper end of the range selected so that in some cases the number of rectifiers required is less than that indicated. The selector, and data sheets covering operation at alternative temperatures and at values other than the upper end of the ranges, are available from the company at School Street, Hazel Grove, Stockport, Cheshire.

London Airport Landing System

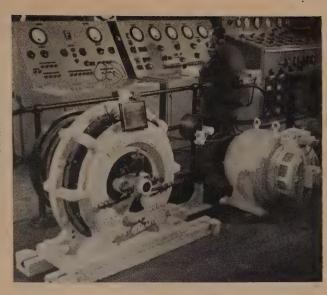
The first installations of a new instrument landing system at London Airport have now been completed. Designed and manufactured by Standard Telephones & Cables, Ltd., this equipment, known as STAN 7/8, has been ordered for installation at major airports including Gatwick, Prestwick, Ringway and Renfrew. Overseas installation work is in progress at Brussels and Zurich. The system provides the pilot of an aircraft with steering information enabling him to make an approach to a runway down to a point from which he can see the airfield lighting, the aircraft then being at a safe gliding angle for landing.

There are three main elements in the London Airport installations—the localiser for azimuth guidance, the glide path for elevation guidance, and the monitoring and remote control equipment for system supervision. No. I runway is equipped for landings from either direction and has two separate and independent sets of equipment. The overall system reliability is ensured by a fully transistorised fail/safe monitoring system linked to a fully automatic changeover unit.

Meter Pioneer

Glimpses of the early experiments and practical achievements of Sebastian de Ferranti, in the generation and distribution of electricity and in its measurement, provide a fascinating introduction to a new colour film about the meter business of Ferranti, Ltd. A skilful blending of live performances with shots of Ferranti's original drawings (with their amusing "doodles") and contemporary sketches of the Grosvenor Gallery, Deptford power station and other landmarks in the history of electricity supply in this country, effectively recreates the excitement and empiricism of those pioneering days.

"The Pioneers" has been produced mainly for the personal use of Ferranti's grandson, the present managing director, to emphasise to customers the company's long standing in the meter business. Ferranti claim to be the largest single manufacturers of elecA still from the Ferranti film "The Pioneers" showing one of Sebastian de Ferranti's generators of 1884 in the instrument test department at Moston. The machine continues to be used because of its particularly good waveform



tricity meters in Britain, and to produce half the country's total exports of these devices. The later part of the film shows how precision components, mass production techniques and vigorous testing are combined in the manufacture of modern household meters in the company's Hollinwood factory.

Mobile Colour TV Unit

A colour television mobile unit, equipped and operated by E.M.I. Electronics, Ltd., can now bring trueto-life colour pictures on a 7ft by 4ft screen to offices, factories, conferences and exhibitions. It carries two of E.M.I.'s new colour TV cameras, which incorporate a novel optical system several times more efficient than relay lens systems. Facilities are also provided on the unit for colour teleciné and colour microscopy.

Cross-Channel Cable

In the description of the 200 kV cross-Channel power link in our issue of 22nd July it was incorrectly stated that the mercury-arc convertors at both ends of the cable are being supplied by Asea Electric, Ltd. This equipment is, in fact, being supplied to the C.E.G.B. and Electricité de France by Allmanna Svenska Elektriska Aktiebolaget (ASEA), of Sweden, who are represented in the United Kingdom by Fuller Electric, Ltd.

Work of the Iron and Steel Board

Although some facts about the composition and work of the Iron and Steel Board are contained in the annual reports of the Board, hitherto there has been no publication giving a comprehensive account of its work. The Board has now issued a booklet giving a detailed account of its composition, aims and activities. It has been prepared particularly to assist steel users, steel producers and others

interested in the steel industry to understand the work of the Board. Copies of the booklet can be obtained from the Board at Norfolk House, St. James Square, London, S.W.1.

Prestcold Chester Showroom

A new showroom was opened on 28th July by Prestcold (Division of the Pressed Steel Co., Ltd.). Mr. G. Wood, head of a firm of electrical contractors at Chester, performed the opening ceremony. Mr. D. A. Field, sales director of Prestcold, gave an outline of a new marketing plan under which the company intends to acquire the businesses of its distributors in England and, in their place, create regional marketing units which will, within limits, be autonomous in their operation. A number of these businesses have already been purchased and negotiations are now being carried out for others. The new showroom, at 53, Upper Northgate Street, Chester, will form a depot of the North Wales branch which has its headquarters at Shrewsbury.

New Guinness Timepiece

Encouraged by the success of its travelling clocks, Arthur Guinness, Son & Co. (Park Royal), Ltd., decided to develop the idea by introducing an even larger and more ambitious clock, the Guinness timepiece. Franco Signs, Ltd., was invited to submit ideas, and the Engineering Design Division of the Franco Group, working in collaboration with the Advertising Department of Arthur Guinness, Son & Co., evolved the basic animated theme. Work on mechanical design commenced in the summer of 1957 and the new timepiece made its "debut" in June last at a garden party held at Park Royal Brewery to celebrate the bicentenary of Arthur Guinness, Son & Co. It is 22ft 3in high, 22ft long and



7ft 6in wide, and includes a number of animated sequences. There are twenty-nine separate mechanisms, each one producing one phase of the animation cycle. These are driven and controlled by twenty-two electric motors which range from the $\frac{1}{2}$ h.p. type down to the small synchronous motors used to drive clock mechanisms. The entire timepiece operates from a 15 A supply.

Caribbean Communications System

The telegraph part of the Caribbean Eastern Islands aeronautical v.h.f. communications system recently inaugurated in Barbados was engineered by Creed & Co., Ltd. teleprinters used are the company's new "Model Seventy-five," which can perform a variety of operational tasks in addition to their basic function. Advantage has been taken of this to provide a "selective calling" system by which a message from any one of a whole network of machines can be sent to any desired selection of the remainder.

Disclaimer

Electro Appliances & Equipment, Ltd., Mitre House, 177, Regent Street, London, W.I, distributors of the "Sigma" range of appliances in this country, ask us to state that they are in no way connected with the Sigma Electrical Manufacturing Co., Ltd., which has recently gone into voluntary liquidation.

Batti-Wallahs' Society

The science of hypnosis is regarded with suspicion, largely due to its abuse by charlatans. That it has its value, however, was explained by Dr. A. A. Mason, who was the guest speaker at

The new Guinness timepiece for which Franco Signs evolved the basic animated theme

last week's luncheon of the Batti-Wallahs' Society. In an entertaining talk he dispelled the idea that hypnotism was a cure for all evils, but indicated some of its uses in the medical profession. J. A. S. Bunting (president of the Society) was in the chair and a vote of thanks to speaker was pro-

posed by Mr. J. Temple Hazell (past-president). Mr. H. E. Fleetham (the "Mate") announced that, in accordance with custom, there would be no luncheon in August.

B.S. Kite Mark

The "Steam-o-Matic" iron made by Best Products, Ltd., has been awarded the British Standards Kite Mark, as fully complying with the requirements of B.S. 1732, Part 2, of 1958. From mid-August onwards this iron will be fitted with a red handle. The black-handled version will remain at £4 118 8d (including tax); the new red-handled iron will retail at £4 os 1d plus 148 7d tax.

Tin Plate Workers' Awards

The Worshipful Company of Tin Plate Workers has made ten awards for its 1960 travelling scholarships.

New Trunking Factory

Last week a new factory for W. G. Walker & Co. (Engineers), Ltd., was officially opened in Fircroft Way, Edenbridge, Kent, by Mr. Hugh Sutherland, vice-chairman of the London County Council Housing Committee.

With 12,000 sq ft of floor space, the new three-bay single-storey building is approximately double the size of the Westminster premises it replaces and there is ample room for expansion on the one-acre site. The factory will be primarily engaged on the production of "Mainstay" cable trunking systems, an example of which can be seen in actual operation supplying electricity throughout the building.

Congratulating this fifty-five-yearold company on transferring its production to Edenbridge, Mr. Sutherland said that the move was an effort to marry together the displacement of industry with the overspill of population from the towns, which he regarded as a national problem. Mr. E. N. Ansell, managing director, explained that it was intended to retain the London offices at Emery Hill Street, together with a depot there holding substantial stocks.

Army Records Office Lighting

A new combined Infantry and G.S.C. Records Office for Northern Command has been opened at the Cavalry Barracks, York. The building is of modern design and the lighting is provided by 466 Crompton Parkinson fluorescent fittings. The contractors for the installation were F. Shepherd & Son, Ltd., York.

E.D.A. 1961 Sales Conference

So successful was the E.D.A. Sales Conference and Exhibition at Harrogate in March this year, that it has been decided to hold the 1961 Conference again at Harrogate and not in London. The dates of the conference are from 28th February to 3rd March. This year an electrical exhibition was organised in connection with the conference and the exhibitors expressed themselves as being pleased with the experiment. Manufacturers have now been asked by the E.D.A. if they would favour an exhibition being organised for the 1961 Sales Conference.

Power Station Valve Contracts

Boving & Co., Ltd., are supplying twenty electrically operated valves having bores ranging from 22in to 42in diameter for the Darwin thermal power station in Australia which is to come into operation in 1962 and will eventually have a capacity of 100 MW. A second Australian project for which Boving & Co. are supplying the valves is the Moondarra and Tyers River scheme, a £A33 million project to bring additional water supplies from the lower reaches of the Tyers river to the growing industrial area of the Latrobe Valley. The contract is for fifteen 36in diameter valves and one 48in diameter electrically operated water regulating valve.

Sea Water Evaporators for the Middle East

The Richardsons Westgarth Group has received a further order worth nearly half a million pounds from the Government of Qatar for two multistage vacuum flash evaporators each having an output of 750,000 gal of fresh water a day. This follows on a previous order for two 150,000 gal a day evaporators which were installed last year at Doha. The two new

evaporators will be installed at the new Ras Abu Aboud power station and will operate on low pressure steam from pass-out turbo-alternator sets. They will provide high purity water for both domestic and boiler feed purposes.

Oil Pump Control

Accurate control of oil pressure in the pipeline-regardless of the number of delivery points in use-is necessary when loading road tankers from distant tank farms. At Esso's Purfleet plant ten bays are provided for road tankers loading heavy fuel oil and these are served by five two-speed motors at the tank farm. The G.E.C. "Multiplex" circuit used is so arranged that an integrating unit senses the number of bays requiring oil delivery and remotely switches on the appropriate pumps at the correct speed to maintain a predetermined pumping pressure. As additional tankers arrive in different bays or loaded ones drive away, adjustments are automatically made to the pump settings. To prevent uneven wear resulting from random pump selection, the switching has been arranged to operate in a predetermined sequence, which is rotated at fixed intervals.

Instructional Servo System

An aid for demonstrating control system theory, the Instructional Servo System type ESIA, which is marketed by Feedback, Ltd., in association with Servomex Controls, Ltd., is now being used in universities, technical colleges and other training establishments. This equipment, which consists of a servo control unit and a servo assembly, can be used directly to demonstrate important aspects of basic theory, such as the effect of gain and damping on transient response. In addition, with appropriate test equipment, detailed measurements may be



This new mobile showroom of Falk, Stadelmann & Co., Ltd., is the largest of the company's fleet. The products are displayed in such a way that they can be easily taken down for inspection



The new Burnley branch of Hirst, Ibbetson & Taylor, Ltd.

taken on frequency response and transient response in both open-loop and closed-loop conditions. The design has been arranged so that the results obtained may be predicted and inter-related by means of simple analysis.

Wholesalers' New Branch

Hirst, Ibbetson & Taylor, Ltd., electrical wholesalers, Salford, have opened a new branch at Finsley Gate, Burnley, to serve north-east Lancashire. Mr. J. Demaine, who has previously represented the company in that area, has been appointed manager of the branch and Mr. F. Stephenson has been appointed sales representative. The new branch is shown in the above picture.

Trade Announcements

As from 1st July the electrical contracting department of J. S. Smith, Ltd., Nottingham, has been acquired by Hardwick Industries, Ltd., of Nottingham. The business has been amalgamated with the electrical engineering department of another Hardwick subsidiary company, John Jardine, Ltd., and will operate as a new subsidiary company known as Jardine & Smith (Electrical Engineers), Ltd.

The registered office of the new company will be Chelsea Street, New Basford, Nottingham. Mr. H. Twemlow, group electrical engineer and electrical engineering depart-

ment manager of John Jardine, Ltd., and Mr. B. O. Knott, electrical contracts department manager of J. S. Smith, Ltd., have been appointed directors and joint general managers of the new company.

Three companies within the Electrical Division of **Tube Investments**, **Ltd.**—Simplex Electric Co., Ltd., Mersey Cable Works, Ltd., and the Power Centre Co., Ltd.—have integrated their industrial sales organisation. As from 1st August, these companies have established a unified selling unit operating from twenty-two Simplex branches throughout the country.

France's Electric, Ltd., has formed a new company with the title of France's Electrical Engineers, Ltd., which will in future operate the contracting division of the company. In addition to the present directors, Mr. H. J. Langford, contracts manager, and Mr. V. J. M. Walker, technical assistant, have been appointed to the board of the new company.

The head office and showroom of the Armfield Electropower Co., Ltd., is now at 13, Long Lane, Ickenham, Middx. (telephone: Swakeleys 2515/6).

The address of **Harris & Sheldon**, **Ltd.**, is now 45, College Road, Perry Barr, Birmingham, 22 (telephone: Birchfields 5801).

Mr. Hans Mäder has been appointed sales supervisor for Switzerland for Wolf Electric Tools, Ltd. His address is: Bürenstr. 33, Lengnau. b. Biel, Switzerland.

Change of Name

Metropolitan-Vickers - G.R.S., Ltd., manufacturing power-operated railway signalling and marshalling yard equipment, has changed its name to Associated Electrical Industries-G.R.S., Ltd., and will carry on all its operations under that name in future. The change is in name only, and is made within the reorganisation of the parent company, A.E.I., Ltd.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Sir Leslie Gamage, who as we announced in our last issue, has relinquished his executive duties as managing director of the General



Sir Leslie Gamage

Electric Co., Ltd., although continuing as chairman until the end of this year, was educated at Marlborough and Oxford where he was senior scholar of Exeter College and took his M.A. degree in 1910. In 1913 he took honours in the

solicitors' final examination. During the 1914-18 war he served with the 24th London Regiment from 1914 to 1919. He was wounded during the Battle of the Somme in 1916, when he won the Military Cross, and was wounded again in 1918, and was taken prisoner. On his return to England he married the elder daughter of the late Lord Hirst

Sir Leslie joined the General Electric Co., Ltd., in 1919 as assistant secretary. He became secretary in 1920 and was elected to the board in 1925 when he assumed responsibility for the company's export business. He was appointed vice-chairman and joint managing director in 1943 and chairman and managing director in 1957.

In his many speeches and Press articles on the subject of export he has always emphasised the importance of British industrial executives visiting overseas territories to experience for themselves the problems of selling in these markets, and he, himself, has frequently made extended visits to Europe, Argentina, Canada, Australia, New Zealand, South Africa, Hong Kong and Malaya. For several years he was chief business adviser to the Ministry of Transport and Civil Aviation and he was president of the Institute of Export for fifteen years. He has also been a member of the Grand Council of the Federation of British Industries for the past twentyeight years and for twelve years served on the Council of Industrial Design. He is also president of the Royal Commercial Travellers' Schools, past-president of the Chartered Institute of Secretaries (1941) and past-master of

the Worshipful Company of Glaziers (1945).

Mr. A. L. G. Lindley, who has been vice-chairman and a managing director of the company since August last year, is now sole managing director. Mr. T. W. Heather, M.C., and Mr. R. E. Robinson, former assistant managing directors, receive a total of £27,700 as compensation on vacating office as executives.

Senior appointments at the Atomic Energy Research Establishment, Harwell, are announced by the United Kingdom Atomic Energy Authority.

Dr. F. A. Vick, O.B.E., at present deputy director of the Establishment, has been appointed director. Dr. R. Spence, C.B., F.R.S., at present chief chemist, has been appointed deputy director and Mr. L. Grainger, now head of the Metallurgy Division, has been appointed assistant director, with special responsibilities for applied research. The new appointments will take effect on 1st September. Sir Basil Schonland, C.B.E., F.R.S., continues as director of the Research Group, of which A.E.R.E., Harwell, is a part.

Sir Willis Jackson, F.R.S., president of the Institution of Electrical Engi-



Sir Willis Jackson

neers, has been appointed to the Chair of Electrical Engineering at the Imperial College of Science and Technology. His appointment exemplifies the close links which now exist between industry and the Imperial College at the

highest level. Sir Willis resigned his chair at the College seven years ago to become director of research and education with the Metropolitan-Vickers Electrical Co., Ltd. (now A.E.I. (Manchester), Ltd.). From this position he has exercised great influence both within the electrical industry and in the field of technological education in general. He is now to return to his old College and his old Department. His appointment, starting in October, 1961, will come at an important time. The Department of Electrical Engineering will be moving into a new building now

in the course of erection which will permit of a great expansion of the College's work, particularly on the post-graduate side. Sir Willis will be joining a team of electrical engineers led by Professor A. Tustin, who has been responsible for the central planning of the new building. Professor Tustin has for some time wished to relinquish the headship of the Department, and this will now be taken over by Sir Willis Jackson. Professor Tustin will continue to direct the work of the Department in the field of heavy electrical engineering. Other leading members of the Department are Professor D. Gabor, F.R.S. (Applied Electron Physics) and Professor C. Cherry (Telecommunications).

Mr. J. G. Kellie, M.Eng., M.I.E.E., manager of the Stafford District of the Midlands Electricity Board, is to retire on 31st August. Mr. Kellie was educated at Christ Church School and University School, Southport, Lancs. After serving an engineering apprenticeship with Cammell Laird & Co. he studied engineering at Liverpool University. In 1923 he joined the Yorkshire Electric Power Co., and was later at Norwich and Ealing. He was appointed engineer and manager of the Stafford Corporation electricity undertaking in 1937, serving in this capacity until nationalisation, when he became manager of the Stafford District. Between 1942 and 1949 Mr. Kellie was hon, secretary of the Central England Centre of the A.M.E.E. and served on the association's national executive for six years during the war.

Mr. S. G. Mundy, M.I.Mech.E., M.I.E.E., managing director of Crypton Equipment, Ltd., has been elected president of the Garage Equipment Association.

Mr. L. R. B. Spence, deputy general manager of the Prescot Works of British Insulated Callender's Cables, Ltd., has retired after thirty-five years' service with the company. Mr. Spence joined the Mechanics Department of British Insulated Cables, Ltd., at Prescot in 1925, and moved to the Wire Mill Department in 1929 where he remained until 1941 when he became a member of the Works Management Department. From 1942 to 1945 he was manager of the Rubber Cables Department, then for three years manager of the Wire Mill Department. In



Mr. D. W. Aldridge, deputy chairman, B.I.C.C. (left), making a presentation to Mr. L. R. B. Spence, deputy general manager, Prescot, on his retirement

1948 he was appointed manager of the Engineering Production Division, later serving as Prescot works manager until 1958, when he was appointed deputy general manager (Prescot).

His colleagues have presented him with a catamaran sailing boat as a parting gift and at a recent farewell gathering at Prescot, presided over by Mr. R. M. Fairfield, director (home operations), a model of the boat was presented to Mr. Spence by Mr. D. W. Aldridge, deputy chairman of B.I.C.C.

The Postmaster General has accepted the resignation of Sir Lawrence Bragg, O.B.E., M.C., F.R.S., from the chairmanship of the Post Office Frequency Advisory Committee. Sir Lawrence, the resident professor and director of the Davy-Faraday Laboratory of the Royal Institution, has been chairman of the Committee since it was set up in 1958, and he is now having to retire from the appointment because of his many other commitments. He has been closely concerned with the current celebrations of the tercentenary year of the Royal Society. In his stead the Postmaster General has appointed Dr. R. L. Smith-Rose, C.B.E., at present director of the Radio Research Station of the Department of Scientific and Industrial Research. Dr. Smith-Rose, after a long and distinguished scientific career in the Civil Service, retires at the end of September, and his appointment to the chairmanship of the Frequency Advisory Committee takes effect from that date.

The Traction Division of Associated Electrical Industries, Ltd., has announced the following appointments:—Mr. J. H. Cansdale, M.I.E.E., M.I.Loco.E., sales manager, Traction Division; Mr. J. C. Way, A.M.I.E.E., A.M.I.Loco.E., deputy sales manager; and Mr. J. Rostron, M.I.Loco.E., assistant sales manager. Other appointments since the formation of the Division include the following:—Mr. M. W. T. Rees, B.Sc., A.M.I.E.E., M.I.Mar.E., M.I.Loco.E., chief engi-

neer, Traction Projects Department, Trafford Park, in addition to his present position as chief engineer, Traction Department, Rugby; Mr. E. T. Bostock, B.Eng., A.M.I.E.E., assistant chief engineer, Traction Projects Department, Manchester; Mr. J. Woodhouse, assistant chief engineer. Railway Signals Department; Mr. D. C. Webb, A.M.I.E.E., M.I.R.S.E., assistant sales manager, Railway Signals Department; Mr. J. O. Sims, B.Sc.(Hons.), A.C.G.I., sales manager, Traction Department, London; Mr. G. A. Ashton, A.M.I.E.E., M.I.Loco.E., assistant sales manager, Traction Department, London; Mr. D. W. Evans, A.M.I.E.E., assistant sales manager, Traction Department, Rugby; and Mr. J. L. Morgan, A.M.I.E.E., assistant chief engineer, Traction Motor Department, Sheffield.

Mr. H. Hinton has retired from Rowlands Electrical Accessories, Ltd., after over twenty-five years' service with the company, with whom he has been special head office sales representative. Mr. H. B. Olive has been appointed sales manager and will be responsible for the home sales organisation. Mr. G. S. Close, general manager, head office, will continue to control the Export Sales Department.

The South Western Electricity Board has appointed Mr. L. Locker,



Mr. L. Locker

A.M.I.E.E., deputy chief engineer; he succeeds Mr. A. G. Milne who was recently appointed Bristol district manager. Mr. Locker received his early engintraining eering with the Rotherham Corporation

Electricity Department. During the last war he served as a captain in the Royal Corps of Signals. He was mentioned in dispatches during the S.E. Asia campaigns where he was attached to the U.S. Air Force and later to H.Q., Royal Air Force in Malaya. He has held various engineering posts with the South Western Electricity Board since 1948, including deputy group engineer, Cornwall, and district manager, East Cornwall (1952-57) and group engineer, Bristol (1957-60).

A Production Engineering Department has been formed at the Newhouse (Lanark) factory of Honeywell Controls, Ltd., for planning and launching new devices and improving production techniques, and Mr. A. Gordon, B.Sc., has been appointed

ELECTRICAL WHO'S WHO

The 1960-61 edition of the Electrical Who's Who, now available, contains about 9,000 entries, covering men and women in all branches of the electrical industry -- supply, manufacturing, contracting, consulting, research, transport, mining and trade associations. Electrical engineers in the Post Office, the Admiralty, the Ministry of Supply and other Government Departments are also included. The Electrical Who's Who is obtainable, price 35s (36s 9d by post) from Electrical Review Publications, Ltd., Dorset House, Stamford Street, London, S.E.I, or from booksellers

manager. Mr. J. Hughes, B.Sc., becomes quality manager of the Newhouse works.

The Uganda Electricity Board announces that Mr. E. Kironde, B.A. (Cantab.), has been appointed deputy chairman of the Board for the next year.

The results of the A.S.E.E. Golfing Society for the past three months were as follows:—May meeting, St. Helens trophy: Winner, Mr. E. A. Langdon. June meeting, Liverpool Cables trophy: Winner, Mr. V. Berger. July meeting, Edmundson and Thermodare trophies: Winners, Mr. R. Dolamore and Mr. F. Lucas respectively. Mr. E. C. Green (manager, Thermodare, Ltd.) is captain of the Golfing Society for 1960.

The annual golf tournament of the E.I.B.A. West of Scotland Branch will be held at Cardross Golf Club on 8th September. Tickets and further particulars may be obtained from the convener, Mr. J. Kerr, c/o William C. Yuille & Co., Ltd., 12, Wellington Street, Glasgow, C.2 (telephone: Central 8021).

Mr. S. Parker has been appointed home sales manager of J. H. Fenner & Co., Ltd. He joined the company in 1950 as West Midlands representative and was promoted Midlands regional manager in 1954.

Mr. A. F. R. Carling has been reelected chairman of the Council of the Public Transport Association for the ensuing year. The vice-chairmen are Mr. R. J. Ellery and Mr. F. W. Hodgkinson.

OBITUARY

Mr. A. E. Diggens.—The death occurred suddenly on 23rd July of Mr. A. E. Diggens, divisional sales mana-

ger of Nife Batteries, Redditch, Worcs. Mr. Diggens, who was responsible for the Traction Batteries Division, had been with Nife Batteries for over thirty years.

Mr. John Sim, general manager of Westool, Ltd., died on 25th July at the age of forty-eight. He received his engineering training with Vickers-Armstrongs, Ltd., and was general manager of Vickers Eastern, Ltd., until 1951, when he returned to England to become sales manager of Oliver Pell Control, Ltd. Mr. Sim joined Westool, Ltd., as general manager in January last year.

WILLS

Mr. F. C. Heayberd, governing director of F. C. Heayberd & Co., Ltd., who died on 10th March last, left £16,368 gross (£15,808 net).

Mr. B. J. Edwards, M.B.E., M.I.E.E., a former director of Pye, Ltd., who died on 16th February last, left £34,761 gross (£18,897 net).

Mr. J. S. James, a senior partner in the former firm of James Bros., electrical engineers, Trowbridge, who died on 3rd April last, left £75,498 gross (£75,330 net).

Mr. W. Dixon, senior partner in the Newcastle office of Messrs. Merz & McLellan, who died on 31st December last, left £246,854 gross (£194,176 net).

Mr. F. S. Thomas, director of Fredk. Thomas & Co., Ltd., who died on 24th February last, left £22,205 gross (£18,434 net).

Mr. E. W. Farr, director of Hackbridge Holdings, Ltd., and of the Hackbridge Cable Co., Ltd., who died on 1st April last, left £35,550 gross (£35,307 net).

Mr. C. N. Rogers, electrical and radio engineer and contractor, founder of C. N. Rogers, Leicester, and a past-president of the Leicester branch of the Electrical Contractors' Association, who died on 29th May last, left £20,747 gross (£20,196 net).

Mr. R. Macleod Russell, A.M.I.E.E., late of R. M. Russell, Ltd., electrical contractors, Carmyle, who died on 30th April last, left personal estate in England and Scotland valued at £22,559.

Mr. W. J. Belsey, formerly manager of the Marine Department of the B.T.H. Co., Ltd., who died on 23rd April, left £9,116 gross (£9,018 net).

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical

ALUMINIUM ingots	ton £186 os od
COPPER, H.C. Electro	ton £251 10s od
Fire Refined 99.70%	ton £250 os od
Fire Refined 99.50%	ton £,249 os od
COPPER Tubes	Ĩb 2s 5d
Sheet	ton £288 5s od
H.C. wire and strip	ton £301 58 od
LEAD, English	ton £.71 58 od
	ton $f.70$ os od
Foreign MERCURY	flask £70 10s od
TIN, block (English)	ton £815 10s od
ZINC, G.O.B. Foreign	ton £88 5s od
BRASS Tubes (solid	
drawn)	lb 2s od
Wire	lb 2s 97d
PHOSPHOR BRONZE	
Wire	lb 4s 3∯d
PLATINUM	oz £30 5s od
RUBBER, No. 1 R.S.S.	02 2 ,50 50 02
	11. a. I.I. a. 3.d
spot	lb 30½d30¾d

industry. The figures given are the selling prices and are those quoted on Tuesday last.

ELECTRICITY AND AMENITIES

A long section of the 1959-60 annual report of the Council for the Preservation of Rural England is devoted to electricity matters. On transmission lines, the report says that the Central Electricity Generating Board has furnished the Council with some breakdown figures about the cost of placing main grid lines underground which are now under examination. "The C.P.R.E. in fact, despite statements to the contrary, have never asked for the main grid lines to be put underground, but we are constantly being pressed to do so and to challenge the statements about the high costs involved. We want to be in a position to reply convincingly to such requests."

The report reviews a number of cases in which the Council opposed the routes of transmission lines and in some cases succeeded in obtaining variations. On distribution lines, the Lancashire Branch is stated to have secured substantial improvements in the routing of "countless" lines, the North Western Electricity Board being

"most co-operative in this direction." The report adds: "But the amount of undergrounding now carried out by the nationalised industry is woefully small compared to the amount readily placed underground before the last war by the original undertakings." Nowadays the Branch is often presented with schemes for overhead reinforcement or extension where all the existing supplies are by underground cable. The Merseyside and North Wales Electricity Board, it is stated, "has not agreed, so far as this Branch is aware, to the laying of any line underground for amenity reasons."

Referring to nuclear power stations, the report says that the C.P.R.E., while appreciating that the safety factor is not the only reason why rural sites have to be chosen, hopes nevertheless that experience will soon justify a substantial relaxation of the rules so that greater flexibility may be introduced into the choice of sites through the lifting of at least one of the restrictive conditions.

B.E.A.M.A. Semiconductor Devices Section

The British Electrical and Allied Manufacturers' Association has established a Semiconductor Devices Section which will provide within the B.E.A.M.A. an expert body to guide manufacturers of semiconductor devices on matters of industrial policy. The Section will co-operate closely with the Valve and Semiconductor Association, and among its objectives will be the work of fostering standardisation of semiconductor devices, both on a national and an international basis. Commercial and contractual matters, including those arising from the operation of the European Community Treaty and the agreement between the E.F.T.A. countries, will be studied together with matters affecting tariffs, import duties and import restrictions.

The chairman of the new Section is Mr. L. E. Thomson, director and manager, Rectifier Section, Westinghouse Brake & Signal Co., Ltd. The secretary is Mr. C. Brooks, B.E.A.M.A., The Red House, Ascot, Berks. (telephone: Ascot 1960), from whom further information can be obtained. The initial members of the Section are: Associated Electrical Industries (Rugby), Ltd., Electronic Apparatus Division and Heavy Plant Division; Associated Electrical Industries (Woolwich), Ltd.; Electric Construction Co.,

Ltd.; English Electric Co., Ltd.; Ferranti, Ltd.; General Electric Co., Ltd.; Hackbridge & Hewittic Electric Co., Ltd.; International Rectifier Co. (Gt. Britain), Ltd.; Philips Electrical, Ltd. (Research and Control Instruments); Standard Telephones & Cables, Ltd.; and Westinghouse Brake & Signal Co., Ltd.

QUALITY CONTROL

AN international conference on quality control will be held at Church House, Westminster, London, S.W.I, on 1st, 2nd and 3rd September. The conference, the annual event of the European Organisation for Quality Control, will be opened by Mr. F. J. Erroll, Minister of State, Board of Trade, supported by Sir Bertram Waring, chairman and managing director of Joseph Lucas, Ltd., and deputy chairman of the British Productivity Council. Eleven papers are to be presented by leading specialists from various countries and there will be many foreign delegates. The conference theme will be "Controlling Product Quality - Its Value to Industry." Further details of the conference can be obtained from the British Productivity Council, 21, Tothill Street, London, S.W.I.

VIEWS on the NEWS

By "REFLECTOR"

ROM Tuesday next until 7th September London Transport is holding an exhibition at Charing Cross Underground Station to celebrate the diamond jubilee of the original "Twopenny Tube"—the $5\frac{3}{4}$ -mile section of the Central Line from Shepherds Bush to the Bank. This was not London's first tube, for the City & South London Railway had been running for nearly ten years and the Waterloo & City Railway for two, but its opening to the public on 30th July, 1900, may well be said to have marked the beginning of the popularity of Underground travel. A contemporary account said "Yesterday the crowds swayed and surged to get on to the They still do. In fact it is hard to imagine how the 400,000 people who use the line every day-it has now been extended to over 50 miles-would be able to travel to and from work if a group of pioneers had not taken the bold step to construct the line at the turn of the century. We may also wonder what traffic conditions in London will be like ten or twenty years hence if a decision is not soon taken to provide the much-needed additional facilities that the proposed Victoria tube would afford.

* * *

Fresh rumours of a move to amalgamate the two Scottish Electricity Boards have quickly drawn protests from local authorities, mainly in the area of the North of Scotland Board. No doubt it is felt that because the main centres of population and industry are in the south, a merger would in effect be a "take over." The Scotsman points out that the Hydro Board was expressly set up as an agent of Highland recovery and commends it for its efforts in that direction. "Nobody has done more for the Highlands welfare than the Hydro Board has; it has made steady progress with its schemes, spreading light and work; and it is not its fault if enough industries to use its power have not appeared." The difficulty now is, of course, to finance the extension of electricity to the more remote areas. Without a substantial industrial load, it is hard to see how much further the Board can go unless obviously uneconomic schemes are subsidised by the Government.

* * *

The decision of the Central Electricity Generating Board to site its second North Wales nuclear power station in Anglesey instead of at Edern in Caernarvonshire seems to have come as a shock to members of the Caernarvon County Council. That authority, "while congratulating Anglesey on their good fortune" has criticised the way in which the matter has been dealt with by the Board, but the main attack is against the Council for the Preservation of Rural Wales. Mr. Goronwy Roberts, M.P. for Caernarvon, said that propaganda against the project by a small minority of people, many of whom did not live in Lleyn, had been incessant, with the result that the Board had withdrawn from the site. The abandonment of Edern, he said, made it even more vital that new industries should be introduced, and added: "Will the C.P.R.W. object to that also? Having wrecked the Edern project will they now support demands for a major new factory in the peninsula, or do they object to everything except the proliferation of roadhouses which desecrate the area in more senses than one?"

* * *

I learn from the Lincolnshire Echo that a strange new use has been found for old lamp posts. It seems that on a farm near Nottingham a system of creep feeding is used in which calves move forward under an electric fence to fresh grazing each day. It was necessary to provide troughs with enough room for 120 calves and easily movable by a stockman without help (if a tractor were used for the job the electric fence would have to be removed). The most successful answer to the problem was found to be an old steel lamp post sawn lengthwise. The two edges were welded together to give a double trough 22ft long. Mounted centrally on two rubbertyred wheels, it is said to be "as mobile as a window cleaner's cart."

* * *

The pages of the *Electrical Review* seventy years ago contained frequent references to the genius of Edison. Not all of his inventions had an enthusiastic reception, however. The issue of 8th August, 1890, for instance, contained a "Bank Holiday Rhapsody" satirising the formation of the Edison Phonographic Toy & Automaton Co. Observing that from the mighty mind of the inventor had sprung the crowning boon and blessing to men and infants, it went on

"We are to have 'talking automata in bar rooms, restaurants, cigar shops, and showrooms of all kinds, to call the attention of customers to particular articles.' Why stop at this dull, prosaic view, when the vista into which even our dull mental vision can penetrate is so glorious? With what rapture must the Wizard of Menlo Park have peered into the future of the talking doll after a few years of development. We can only suppose that his well-known modesty kept him from putting it all in the prospectus..."

Financial Section

STOCKS and SHARES

IN the last annual review of the General Electric Company's affairs which he will make before retiring from the chair, Sir Leslie Gamage gave a cautious appraisal of the outlook for the group. He hoped, however, that the results of last year would be maintained, if not improved upon. His statement indicated disappointment, but no undue pessimism, over the prospect that Government measures might restrict for the time being the demand for some of the consumer products in which rapid increases were recorded last year. On the other hand he disclosed that at £.138 million the order book at the end of March was larger than it had been a year earlier. As already known from the preliminary statement, an 81 per cent expansion of turnover last year, to a record £,117 million, was accompanied by a 13 per cent improvement in the net profit to £4.8 million, before tax, while the net surplus provided almost twofold cover for the 10 per cent dividend. After easing to 33s 6d the £1 shares now offer a yield of just on 6 per cent.

More Mergers

Following Pye's acquisition of control of Telephone Manufacturing, in competition with the consortium of major telephone undertakings, controversy was raised afresh by news of an offer from the latter interests, under the name of Combined Telephone Holdings, for the capital of Phœnix Telephone and Electric. Having agreed to purchase more than half of that company's ordinary capital at 15s per share, they propose to offer the same terms to remaining holders. Phœnix 5s shares, which stood under 10s a month ago, were marked up to 14s 6d. Elliott-Automation are offering three of their 7 per cent preference shares (cashable if required at 20s each) plus seven 5s ordinary shares for every ten 4s shares of Rheostatic. This put a value of about 23s 3d on the Rheostatic shares (which stood previously around 16s 3d) on the basis of a price of 24s 6d for Elliott-Automation ordinary shares. The latter were quoted a little lower despite the accompanying statement to the effect that the company expects to be able to raise the next dividend to 12 per

cent, against the equivalent of $9\frac{1}{3}$ per cent paid this year.

Thorn Electrical Results

Expectations of another fine report from Thorn Electrical Industries for the twelve months ended last March were well satisfied by the figures in the preliminary statement. With trading profits up by a third, and net earnings after tax by 55 per cent to £1½ million, the raising of the dividend from 20 to 25 per cent still appears to leave about three-quarters of the disposable surplus to go back into the business. Additionally, the statement records the realisation of capital profits to a total of over £14 million, which is to be added to reserves, and a proposal to capitalise part of the latter in a 100 per cent scrip issue. The firmness of investment confidence in the future of the shares may be measured by their quotation, at 50s cum-dividend, on a yield basis still not much higher than $2\frac{1}{2}$ per cent despite the increase in the dividend, which comes as a single annual payment.

Berry's Electric Outlook

Having commented upon the 70 per cent increase in last year's earnings and the more than doubling of the dividend (which had already been doubled in the previous year) the chairman of Berry's Electric Magicoal is still able in the full report to describe prospects for the current year (subject to the usual reservations) as extremely favourable. Output, he says, has continually to be increased to meet demands which show no signs of abating. Hire-purchase restrictions have not yet had any adverse effects. In the first quarter following the end of the financial year in March the upward trend in sales had persisted. After improving to 38s 6d the 5s shares showed a yield of a fraction under 4 per cent on the well-covered 30 per cent dividend.

Ward and Goldstone's Growth

Ward & Goldstone 5s shares are now quoted "ex" the 100 per cent scrip issue. At a price of 29s 3d, and assuming a proportionate reduction in the present 35 per cent rate of dividend, they show a yield of 3 per cent. This high investment rating of the shares may be related to the account of the remarkable post-war growth of the business which the chairman gave to shareholders at the recently held annual meeting. In terms of factory space he showed that it is now ten times larger than it was fifteen years ago. Effects of this expansion on the financial results are demonstrated in a table accompanying the annual report. Over the past decade alone the net

profit has been more than trebled. While shareholders have received a steadily growing return on their investment, the company has retained a consistently large part of surplus profits for investment in the enlargement and improvement of production facilities. The scale of capital expenditure rose from about £100,000 in 1950 to £,447,000 last year, by the end of which the revenue reserves were almost four times as large as the issued ordinary capital of £699,000 and provide more than amply for the second 100 per cent scrip issue to be distributed within three years. Liquidity has been maintained on a similarly impressive scale, the current assets in the latest balance sheet exceeding liabilities by practically £2½ million. Mr. S. Goldstone is reported to have made no detailed comment, at the meeting, on the subject of the company's contract with the Ford Motor Company of America.

Telephone Rentals

Progress of Telephone Rentals has produced an almost uninterrupted rise in the level of earnings for more than a decade, and the company took another large step forward in the industrially active conditions of last year. With a surplus equivalent to 48 per cent on the ordinary capital, the dividend was raised to 15 per cent, and shareholders were reminded of the directors' disinclination to recommend an increase in the dividend if it involved any risk of weakening the company's liquid resources or if prospects did not make the maintenance of the higher rate probable. A yield of 3½ per cent on the 5s shares at 22s 6d reflects the progressive character of the investment and strength of the financial position.

Colvern Prospects

In the annual report of Colvern, Ltd., the chairman adds an expression of quiet confidence in the outlook to his review of the past year during which, as already known from the preliminary announcement, net profits rose by more than one-third and provided easily for an increase in the dividend from $27\frac{1}{2}$ to 35 per cent. Trade is said by the chairman to be running this year at a similarly satisfactory level, and work has begun on factory extensions which will employ some £230,000 of the company's liquid assets and be ready for operation in about a year's time. There has been good support for the 58 shares since the announcement of the results; at a price of 42s 6d they yield 4·1 per cent on a dividend covered nearly 2½ times by earnings.

[Owing to the Bank Holiday there are no share lists this week; they will appear as usual in our next issue.]

REPORTS and DIVIDENDS

The Cambridge Instrument Co., Ltd., announces 100 per cent acceptance of its offer to the shareholders of Electronic Instruments, Ltd., and the merger between the two companies has been completed. Permission has been obtained from the Stock Exchange Council to commence dealings in the new shares issued by the Cambridge Instrument Co., Ltd. Electronic Instruments, Ltd., will continue to trade under its own name and trade mark, but both companies will benefit by the co-ordination of their research, production and sales facilities. Mr. P. Goudime, M.A., managing director of Electronic Instruments, has joined the board of the Cambridge Instrument Co., Ltd. Dr. P. Dunsheath, C.B.E., chairman, Cambridge Instrument Co., Ltd., Mr. H. C. Pritchard, B.A., managing director, and Mr. W. E. Lamb, director, have joined the board of Electronic Instruments, Ltd., of which Mr. A. C. W. Norman, O.B.E., will continue to be chairman, Mr. P. Goudime, M.A., managing director, and Mr. D. A. Pitman, sales director.

Elliott-Automation-Rheostatic Bid .-The terms of the share exchange offer by Elliott-Automation, Ltd., for the £150,000 preference and £985,600 ordinary capital of the Rheostatic Co., Ltd., have now been announced. For every 10 Rheostatic ordinary units of 4s, Elliott-Automation is offering three 7 per cent cumulative preference shares of £1 and seven ordinary shares of 5s. For every 10 Rheostatic 6 per cent cumulative preference stock units of 10s, Elliott-Automation is offering three 7 per cent cumulative preference shares of £1 each and two 5½ per cent cumulative preference shares of £1. Philip Hill, Higginson, Erlangers and Hambros Bank will offer to acquire for 20s a share in cash any of the new 7 per cent preference shares of Elliott-Automation allotted to Rheostatic ordinary stockholders who do not wish to retain these shares. The board of the Rheostatic Co. will strongly recommend their stockholders to accept the offers and have indicated their intention to accept in respect of their own holdings.

Phœnix Telephone & Electric Holdings, Ltd. — Combined Telephone Holdings, Ltd., which was formed on 11th July by the consortium of seven companies which unsuccessfully bid for the capital of the Telephone Manufacturing Co., Ltd., has agreed to purchase for cash more than 50 per cent of the ordinary shares of Phœnix Tele-

phone & Electric Holdings, Ltd., at a price of 15s for each 5s share. An offer to purchase the balance of the ordinary shares on the same terms will be sent out shortly.

Berry's Electric Magicoal, Ltd.-The main figures in the accounts for the year to 31st March last were given in our issue of 22nd July. In his circulated statement, Mr. R. Berry (chairman and managing director) says that the year under review was another record one. Sales increased by 43 per cent and the profit, before taxation, rose by 70 per cent. Whilst all departments have contributed to the successful results, "Magicoal" fires have achieved the most striking increase. Over £100,000 was spent during the year on new plant and improvements to the factory buildings and they contemplate similar expenditure in the current year of about the same amount. The factories at Birmingham and Wembley are now working at full stretch and they have been seeking additional premises elsewhere. As the negotiations to acquire a site at Bicester did not materialise they have purchased a modern factory at Bletchley where work on a new factory building will soon commence.

Exports increased by 10 per cent to a new record figure, while exports of "Magicoal" fires to the United States increased by 25 per cent. The Braun "Magicmaid" food mixing machines, which were first marketed last year, have already secured a fair share of the market and sales are growing satisfactorily. Before the coming winter they will be marketing a new electric blanket and a plate warmer. In the first quarter of the current year the upward trend in production and sales has been maintained. The credit squeeze with its accompanying restrictions on hire-purchase has not affected them and they are of the opinion that hire-purchase is not a major factor in the sale of their products. The prospects for the year and for the future are extremely favourable.

General Cable Manufacturing Co., Ltd.—In a letter to shareholders, Mr. C. W. R. Pantlin (chairman) states that the combined trading results of the company and its subsidiary for the six months ended 31st March last have resulted in a substantial loss. The directors are satisfied that this loss is due to the uneconomic market conditions which were outlined in the chairman's last statement and is in no way a question of reflection on effici-

ency in management or production. The abandonment, as from 1st May, 1959, of the traditional pricing arrangements by the leading manufacturers in the cable industry has had far-reaching results and it is estimated that the price war which followed the collapse of prices may already have cost the industry a sum approaching £10 million. During recent months announcements have been made as to price increases, but owing to long-term contracts and other circumstances, such increases have not yet become effective except to a minor degree and it is anticipated that any major improvement will not be possible until next October. There are indications that the confidence between manufacturers, which was largely destroyed in May last year, is slowly being revived and the company is well placed to share in the gradual improvement and ultimate restoration of economic trading conditions which this process should eventually achieve.

Hackbridge & Hewittic Electric Co., Ltd.—In his statement which has been circulated with the report and accounts (Electrical Review, 22nd July, page 156), Mr. A. M. Browne (chairman and managing director) says that they have again achieved a successful year of trading derived mainly from the fundamental decisions taken over the past few years to extend the factory buildings together with the processing and testing plant. These extensions have enabled them to manufacture transformers of a larger capacity and to secure a greater proportion of their output from this larger class of work. Large orders for heavy-duty mercury arc rectifiers have had a similarly good effect on the output from the Rectifier Division.

Dealing with transformers, Mr. Browne says that whereas up to five months ago units of 120,000 kVA at 275 kV were the largest they had made, they have now supplied to the C.E.G.B. two units each of 180,000 kVA. Further similar units will be constructed during the present year and it is hoped that there will be opportunities to obtain orders for still larger units in the near future. Parallel strides have been made by the Rectifier Division. Large substation banks have been equipped with the more recently developed cooled cathode bulbs and supplied to the London Transport Executive and the Southern Region of British Railways as well as to many others at home and overseas. Another working year is now well on the way and they have an excellent order book.

They have decided to expand in a

new area and their subsidiary company, New Switchgear Construction Co., is acquiring the freehold of a factory in Thanet. Mr. Browne refers to the recent acquisition of over 96 per cent of the issued share capital of Bertram Thomas (Engineers), Ltd., and the more recent proposal to amalgamate their group with that of Switchgear & Cowans, Ltd.

Thorn Electrical Industries, Ltd., reports group trading profits for the year ended 31st March last of £3,916,990, against £2,953,536 for the previous year. After deducting all charges, including £764,082 for depreciation and £949,069 for taxation, the net profit is £1,525,988 (against £979,371). During the year the company also realised a surplus of £1,336,264, mainly from the sales of shares in certain subsidiary companies which have not contributed materially to the trading profits of the group. This surplus has been added to general reserve, together with £750,000 from the profit for the year. It is proposed to pay a dividend on the ordinary and "A" ordinary shares for the year of 25 per cent (against 20 per cent), and it is also proposed to capitalise $f_{,2,187,708}$ of reserves by the issue of 6,613,330 ordinary and 2,137,500 "A" ordinary shares of 5s each credited as fully paid on the basis of one new ordinary or "A" ordinary share for each share already held.

Pirelli-General Cable Works, Ltd.-The profit for the year to 31st March last was £264,141, as compared with £805,959 for the preceding year, and after providing £59,737 for taxation, the net balance is £204,404 (against £509,764). A sum of £13,509 is placed to debenture redemption reserve and it is proposed to pay a dividend for the year of 10 per cent (against 15 per cent). The balance carried forward is £1,537,721 (£1,479,535 brought in).

Electrical Components (Holdings), Ltd., reports a trading profit for the year to 31st March last of £342,811, as compared with £286,526 for the previous year. Taxation absorbs £173,952 and the net balance is £170,684 (against £141,938). It is proposed to pay a final dividend of 71 per cent making II1 per cent for the year on capital as increased by a 50 per cent scrip issue and a 30 per cent rights issue. This compares with the equivalent total of 10 per cent for 1958-59.

The Globe Telegraph & Trust Co., Ltd., reports that after providing £500,637 for taxation, the net revenue for 1959-60 is £721,229, as compared with £619,748 for the preceding year. General reserve receives £250,000 and it is proposed to pay a final dividend

of 3½d per 5s share, maintaining the distribution for the year at 6d per

Efco, Ltd. (formerly Electric Furnace Co., Ltd.).—The group profit for the year to 31st March last amounted to £289,881, as compared with £299,877 for the previous year. Taxation absorbs £136,991 and the net balance is £152,890 (against £156,061). The proposed final dividend is 15 per cent, making 20 per cent for the year (against 17½ per cent), and a balance of £45,755 is carried forward (against £40,986 brought in).

Dowty Group, Ltd .- The group profit for the year ended 31st March last amounted to £3,036,863, as compared with £2,166,848 for the preceding year. Taxation requires £1,466,043 and the net profit is £1,570,820 (against £1,078,139). It is proposed to pay a final dividend of $5\frac{1}{2}$ per cent, tax free, on capital increased by a two-for-three scrip issue. The interim dividend was 6 per cent paid on capital of £3.36 million. For the previous year the total was 11½ per cent, tax free, on capital of £2.4 million before a twofor-five rights issue.

Parmiter, Hope & Sugden, Ltd.-The main figures in the accounts for the year to 31st March last were given in our issue of 22nd July. directors in their report state that during the year under review the parent company has maintained its turnover, but rising labour and material costs, together with a greatly increased expenditure on development and testing, has resulted in a reduction of the trading profit. The subsidiary company, J. F. Collier & Co., Ltd., has again experienced difficult trading conditions in the foundry section, and has in addition been undergoing a period of reorganisation and re-equipment. It is expected that the measures which have been taken will bring improvement in the future.

Cables Investment Trust, Ltd .-The net profit for the year to 30th June last is £523,641, as compared with £440,843 for 1958-59. General reserve receives £250,000 and the final dividend is 1s 2d per £1 unit, making 2s per unit for the year (unchanged).

New Companies

A. J. Place (Wholesale), Ltd.—Registered 12th July. Capital £1,000. Wholesalers, distributors and manufacturers of and agents for electrical goods, etc. Directors: A. J. Place and Mrs. Joan Place. Regd. office: 1, Westgate, Southwell, Notts.

Scientific Meters, Ltd.—Registered 9th June. Capital £300. Electronic and automation engineers, etc. D. Parker is the first director. Regd. office: 230-236, Lavender director. R Hill, S.W.11.

G. T. Hale Electrical Appliances, Ltd.—egistered 21st June. Capital £1,000. Registered 21st June.

Manufacturers of and dealers in electrical goods, etc. Directors: G. T. Hale, H. Wayne (secretary) and A. O. Fiteri, Regd. office: 245/9, Whitechapel Road, E.1.

Bankruptcies

G. R. Jacobs and C. J. Trevethan, trading as Dawn Electrical Appliances of 192, Stoughton Road, Guildford, and lately carrying on business at 226, Connaught Road, Brookwood.—Receiving order made 14th Julyon debtors' own petition. First meeting 9th August at 58-61, York Terrace, Regent's Park, London, N.W.I. Public examination 4th October at the Guildhall, Guildford.

S. T. Robinson, electrical contractor, carrying on business at 70, Bayswater Road, Harehills, Leeds, and formerly carrying on business at 73, Pontefract Lane, Leeds.—Receiving order made 19th July on debtor's own petition. Public examination 27th September at the County Court House, Albion Place, Lands Lands Leeds, I.

K. M. Seward, 2, 3 and 4, St. James' Arcade, Newport Road, Roath, Cardiff, radio, television and electrical dealer.—Trustee, Mr. G. H. Down, 106, Walter Road, Swansea, appointed 15th July.

E. H. Thornton, lately carrying on business under the style of Thorntons Electrical Services at 17, Hebrew Road, Burnley, electrical engineer.—Receiving order made 20th July on debtor's own petition.

P. G. Miller, electrical engineer and contractor, lately carrying on business at 2, Laurel Grove, Withington, Manchester.—Receiving order made 21st July on a creditor's

Wards Electrics, 64, Bottom o' the Moor, Oldham, also at 106, Glodwick Road, Oldham, retailers of electrical goods.—Receiving order made 21st July on a creditor's petition. Public examination 27th October at the Court House, Church Lane, Oldham.

House, Church Lane, Oldham.

T. J. Evans, formerly carrying on business under the style of Gatley Electric Services at 82, Chester Road, Hulme, Manchester, and previously carrying on business in co-partnership with another from the same address under the style of T. J. & R. Evans, electrical contractor.—First meeting 9th August at the Official Receiver's office, 20, Byrom Street, Manchester, 3. Public examination 28th October at the Court House, Quay Street, Manchester, 3.

H. R. Jowett, formerly carrying on business with another as J. & L. Domestic Supplies Co., at 60, Church Road, Upper Norwood, London, S.E.19, as electrical appliance retailers.—Order made 30th June granting discharge, subject to six months suspension; to be discharged as and from 30th December

D. W. F. Delve, trading as D. Delve at 182, High Street, Eston, and 107, Parliament Road, Middlesbrough, radio, television and electrical dealer.—Trustee, Mr. C. G. Sparrow, Barrington House, 2, Bowesfield Lane, Stockton-on-Tees, appointed 22nd July.

F. W. Ames, 73, Havelock Road, Bognor Regis, electrician.—Last day for receiving proofs for dividend 10th August. Trustee, Mr. T. H. Parker, 8, Old Steine, Brighton, 1, Official Receiver.

G. B. Solomon, 57, Fore Street, St. Columb, Cornwall, trading as St. Columb Radio, radio and electrical dealer.—Last day for receiving proofs for dividend 9th August. Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay.

Liquidations

Liquidations

Birmingham Electronic Products, Ltd., manufacturers and distributors of electrical appliances, 20, Snow Hill, Birmingham.—Winding up. Liquidator, Mr. W. Le'R. Hand, Colmore House, 21, Waterloo Street, Birmingham, 2, appointed by members and creditors on 18th July. Particulars of claims to the liquidator by 31st August.

Electronic Services (Staines), Ltd., radio and electrical dealers, 141, Kingston Road, Staines.—Winding up. Liquidator, Mr. G. A. Wale, Latham & Co., Walter House, 418-422, Strand, London, W.C.2, appointed by the company and creditors on 14th July.

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Thick Tapes - Thin Tapes

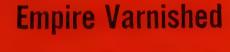




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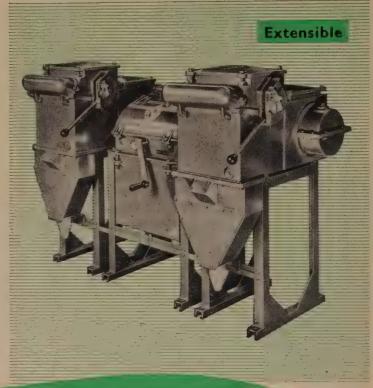
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Automatic Control Systems

CONVEYOR AND FEED DEVICES

By S. W. GOUGH, B.Sc., A.Inst.P.*

The rubber industry has employed automatic control methods for the past 30 years, including the pneumatic type controller amplifier system for steam, gases and liquid heat processes, automatic photo-cell object counters on conveyors and electronic timing mechanisms for production processes. There have also been semi-automatic devices which partially rely on the human operator and although a high level of skill can be achieved by a trained operator, human errors can contribute to reduced quality and increased waste. The modern trend is towards automatic control and this article presents a picture of the needs and scope of application of some automatic systems which have been used and tested in the author's company

WHILE many of the controls used today incorporate electronic elements, the idea that this type of control will completely replace mechanical, pneumatic and hydraulic systems is entirely false. The latter will have their particular applications where high mechanical force is essential and high speed of response is not necessary. Combinations of more than one method often offer the best solution to a difficult control problem.

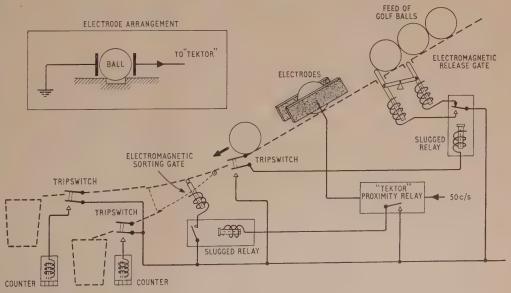
Conveyor Controls

In the sorting of two series of golf balls produced in variable numbers on the same type of machines and in which the only difference was the materials used internally, the only simple characteristic that could be measured and used as a fast sorting difference factor without blemishing the golf balls was that of dielectric constant effect in a condenser field. The total production rate was slightly faster than one ball per second, and the device evolved was arranged to roll them singly down a slope, each ball releasing its successor by a trip switch

at the lower end of the slope to trigger the ball release gate at the top of the slope. As it rolled down the slope, each ball passed between a pair of electrodes long enough to give a capacity signal of a value depending on the interior of the ball in the gap. A commercial oscillator trigger unit, the "Tektor" proximity switch, was modified to respond to the small change of capacity, of the order of ½ pF, existing between the balls, and the relay in the "Tektor" was arranged to control an electromagnetic sorting gate. Trip switch counting in each output path completed the device.

A similar unit has also been used to control levels of liquid in containers or pipes, particularly oils and softeners, in continuous and semi-continuous mixing processes. The electrodes, suitably coated with protective material where necessary, are immersed in the liquid and positioned to operate on capacity change as the liquid falls or rises through the electrode gap. The electrode area and gap must be of dimensions to give a change of capacity of the order of 1 pF when the liquid dielectric fills and empties the gap. The "Tektor" as normally supplied can be made to operate electromagnetic or motorised valves or pumps. A more modern variation of this control uses radioactive isotopes (cobalt 60) emitting gamma rays across the fluid space to operate a detector and give a similar switching action with the presence or absence of the fluid. With this type of equipment the source and

* Development Division, Dunlop Research Centre.



Golf ball sorting mechanism

detector are outside the containing vessel, avoiding any need for inserting glands or connections into the fluid space.

The conveyor systems used in the rubber industry frequently need festoons at various points to cater for matching continuous flow with intermittent feeds and to allow rubber feed under minimum tension forces. The earlier systems employed light roller loading of the festoon operating microswitches, but the present tendency is to use a standard marketed photo-electric cell relay device as a simple on-off system of motor control whenever it is preferable to control the festoon without touching or stretching the material.

Speed Controls

Electronic speed controls have been available for many years and the rubber industry is introducing these to meet its many motor drive problems. These drives permit easy inclusion of constant torque characteristics, necessary to avoid undue speed fluctuations with varying rubber loads. They are being applied to mills, Banbury mixers, rotary tyre test machines, bias cutters, tyre building machines, calenders, etc., and one calender for research work has been equipped with complete separate electronic variable speed motor drives to each bowl.

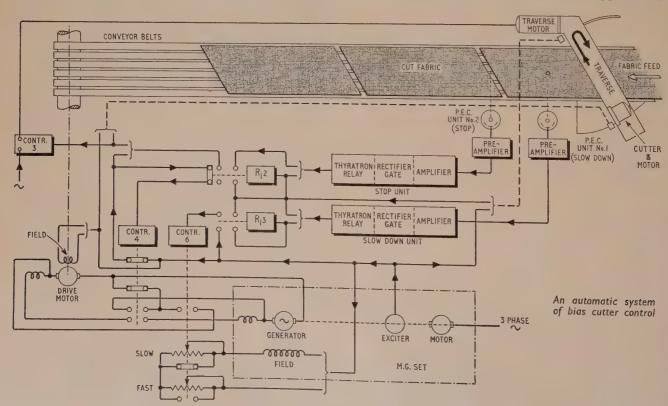
It is relatively easy to link electronic speed controls for slave operation. An example of this is the linking of a complete extruder line where there may be up to 10 motors driving machine units and conveyors which must be linked to avoid stretching the rubber over a wide range of speeds. In this system the conveyors are "slaved" to the first weighing conveyor which is controlled from a reference speed signal picked off the surface of the tread emerging from the die. In the case of duplex extruder lines, each producing a portion of the tread with appropriate initial weighing conveyors, one system is made to

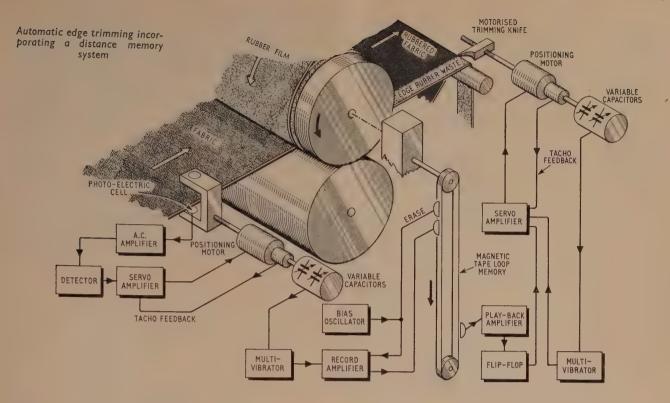
slave the other to give a correct speed match at the joining and consolidating conveyor, the rest of the line slaving the master extruder output as before. This may need further surface speed pick-offs on the extruded rubber, according to the exact method of bringing the extrusions together. At the cooled tread output end of the line, a similar surface pick-off system generates pulses representing tread length which are counted against a reference count in a Dekatron unit. Each time the reference count is cancelled, a flying rotary bevel cutter slices the tread feed giving tread lengths represented by the reference count. With this form of control tread variations have been considerably reduced, by as much as 50 per cent in some cases.

Rubber Fabric Process Controlling

In the past, tyre fabric has been cut on a manually operated bias cutting machine. A good operative produced long-term cut width accuracies averaging $\pm \frac{3}{8}$ in, with some short periods of very accurate cutting. Process widths had to be specified in terms partially allowing for this, and since changes of ½ in on cut widths of rubberised fabric can involve a total of more than 20,000 sq yd of fabric a year per machine, automatic control was called for on both questions of wastage and dimensional accuracy in tyre building. A number of automatic control systems have been used, but all rely on slowing down the fast travel of the conveyor to a very low speed before the "stop to cut" signal to the flying rotary cutter. To achieve it, two separate fabric edge position signals are required, from two light beam photo-cell units, one to signal "slow down" and the other to signal "stop fabric feed and cut."

The table shows the main drive systems that are in use operating from photo-cell signals. The second system was most popularly used in the earlier successful applications,





though there is now a marked tendency to use system 5 for its simplicity, at least in the U.S.A., as some British engineers do not favour double wound a.c. motors. In the second system, illustrated by a block diagram, the advancing edge of the fabric interrupts the first photocell, causing the Ward-Leonard drive to slow down rapidly to a new speed set up by appropriate resistance adjustment in the generator field. When this slow moving fabric edge reaches the second photo-cell the Ward-Leonard drive is stopped and braked and the flying rotary cutter moves across the fabric at its pre-set bias angle. When the cutter reaches the far side of the sheet, a limit switch restarts the conveyor at top speed while the cutter is returning over the top of the fabric.

The rapid acceleration of the conveyor, carrying away the free cut piece of ply fabric, and the deliberate tracking drag of the fabric let-off mechanism cause a gap to develop at the cut, exposing the new advancing edge ready

METHODS FOR PHOTO-ELECTRIC CELL CONTROL OF BIAS CUTTERS

	Drive System	Ist P.E. Cell Action	2nd P.E. Cell Action
ı	A.c. motor-plugging to rest	Switch for reversing motor, centrifugal switch plugging	Applies friction brake just before earliest normal plug stop
2	Ward-Leonard system	Switches generator field to reduced level and removes any series fields in armature circuit	Opens generator to motor armature circuit. Shunts motor armature to rapid stop
3	Grid-controlled recti- fier and d.c. motor	Switches grid control to reduced rectifier output level	Cuts off rectifier feed to motor and shunt motor armature
1	Two a.c. motors and differential gear box and friction brakes	Switches off and brakes main motor switch on low speed motor (via differential re- duction gear)	Switches off and brakes low speed motor to stop
1	Two-speed a.c. motor (double wound machine)	Switches from high speed to low speed wind-	Switches off supply and applies brake (or plug) to stop

for a repetition of the automatic two-stage action. If the flying cutter reaches the start position before the new edge reaches the second photo-cell, a trip switch holds the cutter carriage at rest until the stop signal is received. If the conveyor is already stopped and waiting when the carriage returns to cut start, the carriage immediately recommences the cutting stroke. For many ply widths the cutter can be kept continuously traversing, making 20 cuts a minute. Provided that the machine mechanics are maintained in good condition and the mechanical position drive to the photo-cell is sound, systems 2 to 5 in the table will achieve and maintain $\pm \frac{1}{32}$ in for very long periods. The first system has been made to cut to $+\frac{1}{16}$ in, usually reducing to $\pm \frac{1}{8}$ in as the plug switch wears. Automatic programming from punched tape is easily applicable to these systems and is currently being developed.

One half-way stage to this end exists in an American factory where two pairs of photo-cells have been provided for each photo-cell head adjustment, two ply widths being available at each setting. A programme selection switch provides a choice of continuously cutting one ply width, continuously cutting alternate ply widths, cutting any pre-selected number of plies up to 10 of either width, or cutting alternative sequences of up to 10 plies on each width, not necessarily the same number for each width.

A four-ply-width version of this scheme is also being developed and tyre design is being rationalised in many sizes to fall into two- or four-ply widths per tyre.

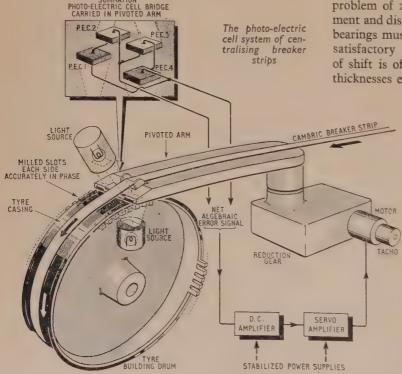
Manual methods of checking and the consequent handling of plies produced errors greater than the limits of the cutting machine. To overcome this a camera attached to the photo-cell head system was used to photograph the fabric edge on a graduated scale, a series of photographs being taken at a number of stop positions to obtain an accurate check of cutting edge position.

Automatic electronic edge followers have been available

for many years and are used in the mould making departments for producing mould cavities to templates or drawings directly, but this type of control is rarely necessary for automatically trimming the rubber selvedge in the calendering of tyre cord fabrics. In these processes, a simple mechanical self-guiding knife is arranged to feel the outer edge cord in its cutting-trimming action, with a further guide resting lightly on the final freshly cut edge nearby as an overriding back stop. With woven fabrics, e.g., p.v.c. coated clothing and furnishing materials, etc., the simple mechanical system is useless. Electronic control, usually photo-cell head sensing systems, has been used in three basic forms. Firstly, a simple single follower control loop where the knife is attached to the sensor head and trimming is within an inch or so of the input fabric edge sensing, or secondly, two follower control loops, one slaved on the other by selsyn link with the knife on the slave to trim some distance farther along the process. This system is only applied to constant speed calendering and in cases of slow edge drifts. Finally, two follower control loops, one slaved on the other but with a magnetic recording memory system, as illustrated, between them can be used. The magnetic recording drive is linked to the calender feed so that the distance between edge sensor and edge trimming is represented by the distance between record and replays in the magnetic memory. Suitably processed in the electronic circuits, the replay signal causes the slave trimming knife to cut the selvedge off to the true shape of the fabric as it arrives at the trimming knife some feet beyond the point where the shape was first followed.

A variation of the electronic edge follower has been applied to achieve square edge batching of sheet materials. In this, one follower loop is employed in which the fabric drive carriage is moved transversely, instead of the photocell edge sensor which is fixed.

In one of the hand-built cycle tyre processes it is necessary to lay a thin rubbered cambric breaker strip





The mechanical breaker strip centralising device

centrally between the beads on flat built casings to an accuracy of $\pm \frac{1}{3.2}$ in or better, with variations of both cambric and casing bead widths in some instances up to in. An extension of edge follower systems using four edgesensing photo-cells, illustrated in block diagram form, was first applied to this problem, and it operated satisfactorily to a better accuracy than was required but seemed complex in comparison with the essential simplicity of the handbuilt tyre process. Before collecting full performance data as a case for its adoption a simpler mechanical device was evolved in which a light roller, held in a pivoted trunnion, is caused to tilt by the cambric breaker strip according to its degree of off-centre. The tilt tightens one edge of the strip more than the other causing the cambric to centralise until the tilt reduces to zero. A finger system running on the bead wire edges of the casing automatically centres the trunnion pivot.

In the past, all film measuring principles that have been applied to rubber calenders have suffered from the problem of zero shift due to unavoidable random movement and distortion of the bowl bearing assemblies. These bearings must have some degree of working play to allow satisfactory operation of the machine, but the amount of shift is of the same order as the actual values of film thicknesses encountered in this type of calendering. The

relatively new beta-ray film gauges, however, have a plateau property in their mounting geometry which can allow positional shifts of the film along the radiation path of the order of sin, which is greater than the machine shifts likely to be experienced, without affecting the instrument zero. These gauges are in the class which do not involve any solid contact with both film surfaces simultaneously—always a desirable feature—and there is a growing tendency to apply them in preference to others.

The radioactive isotope usually employed is strontium 90, though some earlier versions used thallium. There are two basic types, transmission beta-ray gauges—where the source is on one side and the detector is on the other side of the film, and



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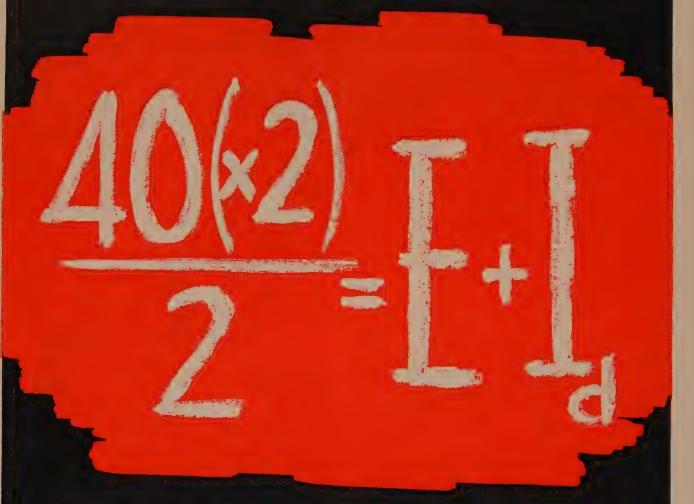
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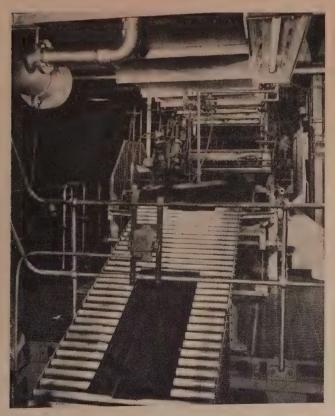
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backscatter beta-ray gauges—where both source and detector are on the same side of a film, the other side being backed by a heavier material such as steel. The first type gives readings which are a function of weight per unit area of the film which is in the path of the radiation, and they have proved an accurate method of measuring the weight of output sheets leaving the calender. Successful automatic bowl nip control of rubber films on three-bowl calenders, producing single topping of fabrics, is now a commonplace system, and uses transmission beta-ray gauges. In the U.S.A. fully automatic control of double topping processes consists of two such three-bowl calenders in tandem, one for each side of the fabric to be topped.

The backscatter gauges are applicable to the films on the calender bowls, essential in the English method of four-bowl calendering which tops both sides of the fabric simultaneously. Unfortunately this type of gauge as commercially available gives readings which are a function of weight per unit area of the film on the bowl and a function of the mean atomic number effect due to all the constituent elements in the rubber. The normal commercial gauges are thus satisfactory only in processes using one rubber compound more or less continuously. The range of compounds in a tyre factory causes a change of weight calibration on these gauges by as much as 300 per cent due to atomic number effects, and this range of compounds is run quite frequently on each calender. However, patented developments by the Dunlop Rubber Co. are now reaching the stage of being applied to automatically compensate backscatter gauges for the rubber compounds being measured, and a set of these instruments is being applied to give completely



Part of the duplex tread extruder line showing the automatic tread length cutter

automatic film gauge nip control of a four-bowl calender system. The prototype system has already been proved over the required range of compounds. The beta-ray sources decay slowly, having a useful half-life of 20 years and the sources are usually replaced every 10 to 15 years. Daily checks of sensitivity and zero should be made to allow for this, though it is becoming normal practice to make the instrument do this automatically at regular intervals, particularly if it is to operate automatic bowl nip control.

The importance of reliable film gauging and automatic nip control can be appreciated from the fact that a change



Beta-ray transmission gauge

of 1 oz/sq yd (0.0012in approximately) represents something approaching 300 tons of mixed rubber per year per calender at the usual continuous feed rates. The resolution of the beta-ray gauges is at least 0.2 oz/sq yd and the experiments suggest that it is possible to make the calender mechanics control to $\pm \frac{3}{4}$ oz/sq yd on the total weight of two films, with the possibility of reducing to $\pm \frac{1}{2}$ oz/sq yd in due course.

Automatic Weighing

Various forms of load cells are available in which the load or force is carried by a stressed member and either the strain or the deflection is measured with strain gauges or inductance transducers. The output of the associated electronic circuits, calibrated to read load directly in lb or tons, is metered or charted. Interposing this into conveyorised material feeds enables automatic, continuous or sequence weighing to be carried out as desired. This system is forming the basis of automatic rubber mixing processes which are gradually being evolved for use with

Banbury mixers. Automatic weighing is applied in other situations where items are check-weighed. Rolls of fabric, for example, are automatically check-weighed when being moved. The load measuring unit is in the form of a tension link in the hoist sling, and the resulting weight can be indicated, charted or digitised and printed direct on to stock cards, avoiding human error.

Laboratory Test Machines

The useful features of automatic control and electronic methods are not confined to the production departments, but can also be used in routine laboratory measurements. Normal tensile tests are being made more automatic, the whole test proceeding from a pushbutton initiation, automatically drawing the curves of stress and strain corrected for the original cross-sectional area of the test piece which varies in successive test pieces when cut from rubber. In a constant power type of abrasion machine comparing the abrasion resistance of laboratory test compounds, a special test to be run on a routine basis was necessary. The constant power requirements involved automatic constant speed control of the abrasive wheel shaft and a constant current control to an eddy current brake as load on this shaft. Slip between the rubber test piece and abrasive wheel was measured by a photo-electric stroboscopic system and a later version used the stroboscopic signals to automatically control the degree of slip. The test sequence, including starting the motor, the control of speed and load and stopping was automatically carried out.

Future Aspects

The installation of electronic or automatic controls in a factory usually leads to a rapid growth of the control idea. When successive controls are installed in a series of processes some of the earlier systems become redundant due to the greater effectiveness of the later controls, but in this way process line efficiency evolves. Modifications must be made to any individual part of the process which is varying outside reasonable current limits. It is unlikely that each automatic control will always match its neighbour in output rate, and production flooding or starving would occur with continuous operation. Some form of automatic link will be needed and computers will inevitably become part of the overall scheme. At this point completely automatic planning and manufacture evolved direct from order demands, design data and stock records, can be visualised.

Computers are gradually being introduced in laboratory test machines, result analysis and special inspection and grading machines. Electronics are being used to simulate the factors in factory problems, service problems and design variations and control problems making a rapid exploration of wide ranges of the variables possible, giving a more accurate choice of optimum data or more rapid realisation of the possibilities of a system or scheme.

New London Tube "Indispensable"

THOUGH the costs of the proposed Victoria Underground line will probably not be fully recovered from the fares of the passengers who actually use it, from the wider aspects of its economic and social benefits the London Transport Executive are firmly of the opinion that "the line is indispensable and must be built."

In their annual review for 1959* the Executive recall that last December the London Travel Committee came out strongly in favour of building the line and recommended that construction should start as soon as possible. An aspect (the Executive continue) which is sometimes overlooked in discussions limited to a narrow consideration of the financial return on the line taken by itself, is that the British Railways' suburban electrification schemes will be much reduced in effectiveness if the capacity for onward journeys by Underground from Liverpool Street, Kings Cross and Victoria is not improved by the additional facilities of the Victoria Line. "The essential need for good passenger transport facilities of the roads in London is not in doubt."

Work on modernising the existing Underground lines continued. The extension of electrification from Rickmansworth to Amersham and Chesham was well advanced by the end of last year and is due for completion in the "late summer." The second part of this £9 million scheme, the "four-tracking" of the line between Harrow-on-the-Hill and Watford South Junction, was started last autumn and should be completed in 1962.

Twelve prototype cars are being built "to a new design more advanced than has yet been seen on the Underground, and it is hoped that this stock will constitute a basis for the tube rolling stock of the future." All axles will be motored, plastics will be employed extensively inside, and the bodies will be of semi-integral construction. Unfor-

*"London Transport in 1959." London Transport Executive, 2s 6d.

tunately, delays in production of these prototypes (due in some measure to supplies of materials by sub-contractors) have meant that it will not be possible to complete test running before the date at which bulk orders must be placed for the new trains for the Central Line.

The prototypes are being designed so that regenerative braking can be installed at a later date. Experimental work on the application of this system of braking, which was started in 1955, has been completed and a technically practical scheme devised. However, it has now been decided that it would be uneconomic to modify existing stock and it has yet to be settled whether future development is justified on economic and operating grounds.

The work of extending and modernising the Underground power distribution system continues. Three new substations and the modernisation of four old ones were nearing completion. A further stage, costing over £3 million, in which another fourteen substations will be modernised in the next two years, was started.

The report continues the obituary of London's trolley-buses. By the end of 1960 eight of the fourteen stages of replacement will have been completed. At the end of 1959, 330 trolley-buses out of the former total of 1,340 had been withdrawn and replaced by 360 buses; 198 miles of road were still worked by trolley-buses.

Following the satisfactory operation of the Bus Electronic Scanner Indicator Equipment (B.E.S.I.), it is proposed to enlarge the scope of the experiment to cover a further five routes, using altogether fifty scanners and six control panels. At the end of the year "electrical engineering staff" totalled 2,276, half of whom were engaged on maintenance.

During 1959 London Transport paid its way, meeting in full all operating costs and interest charges on capital and ended the year with a small surplus of £30,000.

GENERATION AND DEVELOPMENT

Fuel and Power Statistics

Evidence of the extent to which electricity is being substituted for other fuels in the home and by industry is provided in the latest edition of the Ministry of Power Statistical Digest 1959 (H.M. Stationery Office, 30s).

Between 1949 and 1959, while total fuel consumption increased by 14 per cent, consumption of electricity increased by 60 per cent. Electricity consumption, which in 1949 represented 14 per cent of the total fuel consumption, had increased to 21 per cent of the total in 1959.

Nineteen out of the 130 tables in the Digest relate to electricity supply and one of these, analysing electricity sent out and output capacity of power

Electricity Output in the U.K. (Including Northern Ireland)

			1958	1959
Public supply:		Millio	n kWh	
Thermal Hydro		:::	91,827 2,102	98,092 2,166
Total			93,929	100,258
Industrial pro Thermal Hydro Nuclear		:	12,472 597 305	12,643 527 1,201
Total			13,374	14,371
Transfers from producers supply Exported (from Ireland to	to p	ublic hern	753 I	1,627
Total availal sumption	ole for	con-	94,681	101,884

* Partly estimated.

stations according to plant load factor, is reinstated after a lapse of some years. This shows that in 1958 the eight stations operating at load factors of 75 per cent and over accounted for 6-9 per cent of the total capacity and 13-2 per cent of the electricity sent out. In the same year 55 per cent of the total electricity sent out from steam stations came from stations with a works cost of generation per kWh sent out below the average of 0-653d.

Another table covers electricity generation by the fuel industries and railway and transport authorities. This gives the following figures for 1958 (million kWh):—Coal mining, 1,356; gas supply, 145; mineral oil refining, 331; and transport undertakings, 1,115.

Oil-filled Cable at Leicester

For the past few months engineers of the A.E.I. Construction (Cables and Lines) Division have been engaged on the supply, installation, and jointing of duplicate 132 kV feeder cables at Leicester. The cable, 4.85in in diameter over the serving, is a 0.60 sq in 3-core oil-filled type with compacted circular copper conductors and aluminium oil ducts, single lead alloy sheathed and tin bronze reinforced, with protective serving. Along with these feeders combined pilot and telephone cables were laid.

The contract, valued at over £100,000, was awarded to A.E.I. by the East Midlands Electricity Board, who had planned the cable route through the streets of Leicester between Freeman's Meadow generating station and a new substation at Blackbird Avenue. The scheme is to reinforce the electricity supply in the northern area of the city and the work has been planned with a view to supplying a number of new 33 kV major substations from the two 132 kV feeders.

Assessment of Domestic Premises

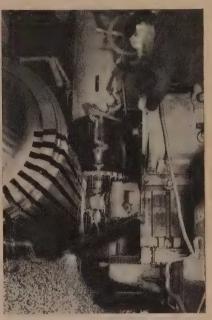
The Southern Electricity Consultative Council is to ask the Board for a re-statement of policy on assessable rooms under the domestic tariff. In the course of discussing a case which had come before the South Western District Committee the Council decided at its meeting at Fawley on 19th July that the policy of the Board was not quite clear regarding the assessment of a living space which, though without partitions of any kind, had a dual function, e.g. dining room and sitting room. The Board's domestic tariff pamphlet states that assessable rooms with structural divisions such as fixed or folding partitions count as two or more rooms, as the case may be, and makes no mention of the assessment of an undivided space as two or more rooms on a functional basis.

Installations in Municipal Buildings

Bootle Corporation is applying for sanction to borrow £42,966 for electrical installation work at the Town Hall, Municipal Offices, Central Library, Central Police Station and Balliol Road Baths, including the provision of a substation in the basement of the library.

Plant for Kincardine

The accompanying picture shows the slotting of the alternator rotor forging of one of the two 200 MW turbo-generators which the General Electric Co., Ltd., is supplying for installation in the South of Scotland



Slotting the alternator rotor forging of a 200 MW turbo-alternator for the South of Scotland Electricity Board's Kincardine power station

Electricity Board's Kincardine generating station. The alternators will have water-cooled stator windings and direct hydrogen-cooled rotor windings, the gas pressure being 50 p.s.i.

Future of Scottish Boards

Sutherland County Council, at its meeting at Lairg on 25th July, decided to protest strongly against any proposal to amalgamate the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board, and to ask the Secretary of State for Scotland for more information about a Press report that the matter was to be raised in Parliament with a view to amending legislation.

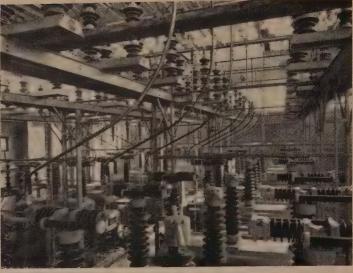
Mr. G. MacIver said the North of Scotland Hydro-Electric Board had done a great deal to arrest the very rapid depopulation in its area. The Highlands and Islands had special problems which could only be dealt with there. According to their experience, where there had been complete centralisation it was, generally speaking, not to their benefit. With one exception, Mr. MacIver said, all the Highland M.P.s were opposed to the suggested amalgamation.

Hunterston Switching Station

The 132 kV switching station associated with the South of Scotland Electricity Board's nuclear power station at Hunterston is now at an



Hunterston switching station and (right) an interior view of the station (partly completed) showing A.E.I. air-blast circuit-breakers, isolators and connections



advanced stage of erection. As a protection against the high degree of local atmospheric salt deposit, the station has been built indoors. A.E.I. switchgear of the standard outdoor type has been used, and with the compact design of the circuit-breakers and the special arrangement of the busbars and isolators, a notable space-saving layout has been achieved. The circuit-breakers are of the air-blast type, rated at 3,500 MVA at 132 kV.

Hire Charges to be Raised

The South of Scotland Electricity Board has announced increases in hire charges for cookers, wash-boilers, water heaters and other appliances as from the first meter readings after 30th September. The new quarterly charges for two-plate cookers will be 14s 6d (solid) and 17s (radiant) and for three-plate cookers 17s and 19s respectively.

OVERSEAS

World Bank Loans

A large expansion of electric power supply in Lima, Peru, by the Lima Light & Power Co. is being backed by the World Bank to the extent of \$24 million. The work includes a scheme for diverting the water of a number of lakes and rivers into the Santa Eulalia river basin for hydroelectric purposes and the construction of a 120 MW station at Huinco, on the Santa Eulalia.

An \$8.8 million loan is being arranged by the World Bank to finance the development of electricity in Honduras, including a 27 MW hydroelectric station and transmission system.

Nuclear Offer to Argentina

The "British engineering group" which, as we recently reported, has offered to install nuclear power plants

in Argentina is the Mitchell Engineering Group, Ltd. The Journal of the British Chamber of Commerce in the Argentine Republic quotes a member of the firm's staff, Mr. M. Widett, as saying that the number of plants would depend on the decision of the Argentine Government. Credits, he said, had been arranged in respect of

"70 per cent of the total cost of the plant ready to produce electricity." The cost would depend on the size of the installation, but the construction cost per kWh was not higher than that of a thermal plant, and after four or five years' operation the difference in cost between a nuclear and thermal plant would be saved in fuel.

RECENT C.E.G.B. CONTRACTS

The Central Electricity Generating Board has placed contracts during the past month for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £4,930,000. They include the following:—

Thorpe Marsh power station (nr. Doncaster): 415 V switchgear, switch-fusegear, motor control gear, and accessories.—English Electric Co.

High Marnham (nr. Newark): Scrapers for coal handling.—John Blackwood Hodge & Co.

Skelton Grange "B" (nr. Leeds): Three site shunting locomotives.— Yorkshire Engine Co. Canal barge coal-unloading plant.—Clyde Crane & Engineering Co.

Blyth "B": Booster, starting and standby boiler feed pumps for Nos. 7 and 8 350 MW turbo-generators.—Sulzer Bros. (London).

Rugeley: 3·3 kV air-break, 150 MVA switchgear.—A. Reyrolle & Co. 415 V contactor switchgear. — Brookhirst Igranic.

Uskmouth "B" (nr. Newport, Mon.): 144 MVA, 13.8/145.4 kV transformer.—G.E.C.

Aberthaw (nr. Barry): 6-6 kV, 250 MVA switchgear and accessories.—A.E.I.

Richborough: Instruments and control equipment.—Electroflo Meters Co.

Brunswick Wharf: Uprating 132 kV switchgear.—A.E.I.

Kirkby 132 kV substation: 132 kV outdoor switchgear.—A.E.I.

High Marnham substation: 400 MVA, 380/275 kV auto-transformer.— English Electric Co.

Monk Fryston substation: 400 MVA, 380/275 kV auto-transformer. — Ferranti.

Corby substation: Two 180 MVA, 275/132 kV transformers.—English Electric Co.

Bustleholm substation: Two 180 MVA, 275/132 kV transformers.—G.E.C.

Nechells substation: 132 kV, 3,500 MVA switchgear.—G.E.C.

Brinsworth substation: 275 kV overhead lines.—British Insulated Callender's Cables. 275 kV, 7,500 MVA switchgear.—A.E.I.

Rugeley-Whitfield: 132 kV overhead line.—A.E.I.

Ironbridge-Oswestry: 132 kV overhead line.—Balfour Beatty & Co.

Hart Moor substation: Civil works.

—Tarslag.

Whitson (Newport Steelworks) substation: Site and foundation works.—A. Jackaman & Son.

Willesden Grid-Taylors Lane: 132 kV and 33 kV cabling.—Pirelli-General Cable Works.

Basildon-Pitsea: 25 kV cabling.—B.I.C.C.

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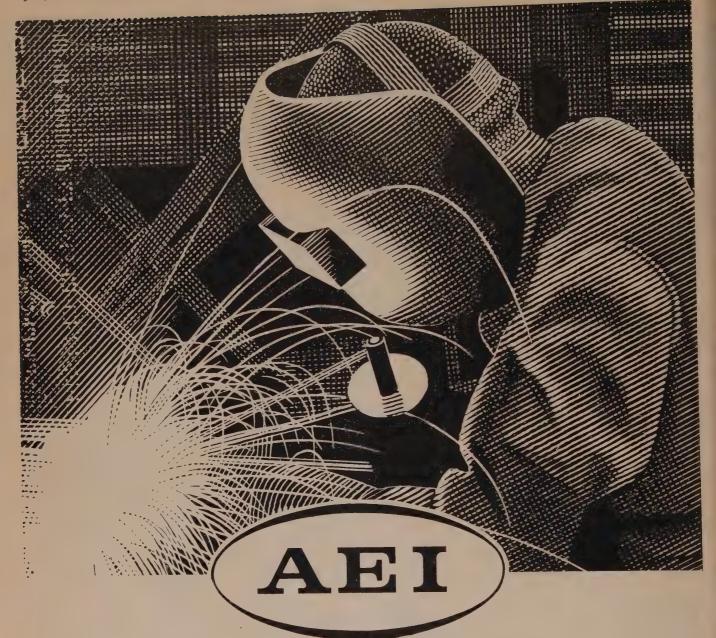
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Ireland's Power Resources

PLANS FOR FURTHER PEAT-FIRED STATIONS

PERATING conditions in the year ended 31st March last were on the whole rather favourable, states the annual report of the Electricity Supply Board, Ireland. The lack of rain up to the end of October was more than compensated for in the latter part of the year and the output of hydro-electricity for the whole year was some 6 per cent above the average. Moreover, the good summer weather facilitated the production of peat and the electricity produced from this source showed a substantial increase on the previous year.

A total of 2,096 million kWh was generated, 10·4 per cent more than in the previous year. Production from water power amounted to 747 million kWh (against 782 million in the previous year) and from turf 692 million kWh (against 418 million). Expenditure on native fuels increased by over £950,000 while expenditure on imported fuels fell by £340,000. The following analysis shows the percentage of the total output supplied by hydro and thermal plant:—Hydro, 37 per cent; peat (sod), 11·3 per cent; peat (milled), 21·1 per cent; coal (native), 4·1 per cent; and oil/coal, 26·5 per cent. Thus, generation from native sources amounted to 73·5 per cent of the total.

Water Power Fully Exploited

As the development of significant water power resources has now been virtually completed, future additional power requirements will have to be supplied exclusively from thermal stations; there is no new hydro plant in the forward generating programme recently approved by the Government. Consequently there will be a tendency for the average cost of production to rise from now onwards.

The number of new consumers connected last year was 20,025 (including 13,458 in rural areas) and the total at the end of the year was 610,946. Sales of electricity realised £14,724,000, an increase of £940,000 over the preceding year. Merchandise sales amounted to almost £1 million.

The total expenditure chargeable to revenue increased during the year by £1,274,566. Of this £283,022 related to interest, capital repayments and provision for plant renewal and £613,081 to increased expenditure on fuel. The increase in working costs is a reflection of the expanding market which is being built as well as of the higher salary and wage rates which have to be met.

After meeting all charges there was a deficiency of £432,552 (£98,883). The sale of electricity has now resulted in deficiencies in three successive years. Commenting on the present financial position and prospects, the report says that the conclusions to be drawn "seem to point towards a revision of the present rates of charge

and the Board is anxious that the situation should be fully understood by electricity consumers."

As regards rural electrification finances the report points out that when the scheme was initiated it had been agreed that, in order to reduce the burden on the Board's finances, 50 per cent of the capital would be provided free by the State. State policy was altered, however, when less than one-fifth of the total number of areas had been completed, payment of subsidy being discontinued. At 31st March, 1958, when the 50 per cent capital subsidy was reintroduced the Board had spent approximately £23 million on rural electrification of which the State had borne only £1,980,000 or 8.6 per cent of the money spent. The effect of the loss of almost £9,500,000 in subsidy is to add a continuing annual burden of over £,500,000 on the Board's finances in respect of rural electrification, which has to be borne by urban and industrial consumers. Even with a 50 per cent capital subsidy, the estimated returns from the areas now being developed are not sufficient to make them remunerative.

Future Plant Programme

No new generating plant was commissioned in the year under review, the installed capacity at 31st March last amounting to 688.5 MW. Two additional stations, which will use milled peat, are at present in course of construction at Rhode, Co. Offaly (80 MW) and at Bellacorick, Co. Mayo (40 MW). When these are completed the installed plant capacity will be 808.5 MW of which 285 MW will be fired by peat.

With the general approval of the Government the Board has adopted a programme of plant extensions covering the period up to 1968-69. This envisages the addition of a further 340 MW of plant of which 160 MW will be fired by milled peat and 180 MW by coal or oil. This programme provides for the absorption of the output of all the peat bogs which Bord na Mona have planned to develop for fuel supply to electricity stations. The planning of the first stages of this programme, for completion in 1964-65, is already in hand, consisting of a new station at Shannonbridge (milled peat) 40 MW; the extension of Ferbane station (milled peat) by 30 MW; and the extension of Marina (Cork) station (coal/oil) by 60 MW.

Rural Electrification

The total number of rural areas in the country is now 791, of which 722 (91 per cent) have been selected for development and 688 (87 per cent) have been completed. The proportion of dwellings connected in the completed areas is approximately 75 per cent. During the year 40 new areas were completed and 13,458 consumers connected.

The experimental work on the uses of electricity in agriculture and horticulture was continued at the Faculty of Agriculture Farm of University College, Dublin, at Glasnevin. An advisory service on the artificial curing of hay has been set up and the first field installations were put into operation in the 1959 season.

The Board has installed some group water supply schemes on a trial basis and it is expected that experience of these schemes will help towards the provision of adequate supplies of running water for farms and rural dwellers in general.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

Philips Electrical Industries, Ltd. -Production of articles comprising a conductive metal pattern on an insulating support.

Ist June, 1956. (Cognate application, 30th June, 1955, 18937.) (841864.)

17549. English Electric Co., Ltd.—Electromagnetic relays. 15th June, 1956.

18246. Young, S. G.—Electrical socket connectors. 22nd June, 1956. (Cognate applications 18247, 23rd June, 1955, and 13911, 4th May, 1956.) (841556.)

19882. Lincoln Electric Co., Ltd.—Elec-ic welding equipment. 8th October, 1956.

(841862.)

26610. Metropolitan-Vickers Electrical Co., Ltd., and British Thomson-Houston Co., Ltd.—Nuclear reactors. 22nd November, 1956. (841992.)

27687. Electric & Musical Industries, Ltd.
—Colour television apparatus. 13th September, 1956. (842081.)
28814. Smith & Sons (England), Ltd., S.

-Magnetic amplifiers. 10th October, 1956.

30489. Elliott Bros. (London), Ltd.— Devices for the propagation of mechanical waves. 23rd October, 1956. (841993.)

31633. Siemens Edison Swan, Ltd.— Chain circuits such as are used for storage purposes in automatic exchange systems. 19th October, 1956. (841844.)

British Thomson-Houston Co., Ltd.—Luminescent materials. 5th November, 1956. (842084.)

35134. Siemens Edison Swan, Ltd.—Manufacture of fluorescent screens. 27th November, 1956. (Addition to 6996o.) 36996. Charlotte, H. F.—Cathode ray tube screens. 21st December, 1956. (842086.)

7991. British Thomson-Houston Co., Ltd.-Electrical impedance networks. 21st February, 1957. (842087.) 11796. Philips Electrical Industries, Ltd.

-Semiconductor devices. 18th April, 1956.

British Thomson-Houston switchgear. 29th April, Ltd.—Metalclad 1957. (842088.)

13051. Engel & Gibbs, Ltd.—Electric conducting liquid control devices. 24th April,

1957. (Addition to 793173.) (842089.) 17586. Kolster-Brandes, Ltd.—Television receiver scanning system. 31st May, 1957. (841564.)

Standard Telephones & Cables, Ltd.—Registration of calls in telecommunication exchanges. 28th June, 1957. (841949.)

22117. British Thomson-Houston Ltd.—Detection of deterioration in insulating oils. 22nd August, 1957. (842003.)

24173. Philips Electrical Industries, Ltd. Ferromagnetic materials. 7th August, 1956.

Kokusa Denshin Denwa Kabushiki-Kaisha.—Electric digital computing devices. 22nd August, 1956. (841851.)

27211. Nippon Telegraph & Telephone Public Corporation.—Switching system for two signals of different phase relationship.
5th September, 1956. (841571.)
27473. General Electric Co.—Electrical resistance heating arrangements. 7th Sep-

tember, 1956. (842013.)

27529. Reyrolle & Co., Ltd., A.—Electric distribution systems. 7th September, 1956. (Addition to 755016.) (841572.)

27717. Sperry Rand Corporation.— Switching systems. 11th September, 1956. (842014

Bird Electronic Corporation. 28019. Power measuring units. 13th 1956. (841856.)

Scania-Verktyg A.B.—Single-phase

motors. 19th September, 1956. (841575.) 29376. Plessey Co., Ltd.—High frequency apparatus. 26th September, 1956. (842143.) 29679. Philco Corporation.—Signal translating apparatus utilising semiconductor devices. 28th September, 1956. (841577.)

30331. Radio Corporation of America.—Colour television systems. 4th October, 1956.

30634. General Electric Co.—Cathode-ray tubes, 8th October, 1956. (841832.)
32684. International Business Machines Corporation.—Electrical calculating system. 26th October, 1956. (842042.) 32978. Ericsson Telephones, Ltd.—Mag-

netic switching circuits. 9th October, 1957. (841622.)

Automatic Electric Laboratories 32992. Automatic Electric Laboratories, Inc.—Electronic telephone systems. 29th October, 1956. (841836.)

34305. Phileo Corporation.—Magnetic deflecting circuits for cathode-ray tube apparatus. 9th November, 1956. (841624.)

34902. Fancy Metal Goods, Ltd., and Leiter, H. J.—Electric lighting fittings. 15th November, 1957. (842044.)
35275. Philco Corporation.—Cathode-ray tube apparatus. 19th November, 1956.

(841625.)

35292. General Electric Co.—Electric dis-narge devices. 19th November, 1956. (841883.)

International Business Machines Corporation.—Transistors and the manufacture thereof. 20th November, 1956. (842103.)

39308. International Business Machines Corporation.—Assembly of magnetic core arrays. 27th December, 1956. (842018.)

498. Sylvania Electric Products, Inc.—Dissipationless differential phase shifters. 4th

January, 1957. (842110.)

501. Directia Generala a Radiodifuziunii.

—Method and apparatus for generating a frequency modulated electrical oscillation. 4th January, 1957. (841628.)

Busch-Jaeger Dürener Metallwerke A.G.—Electric toggle switch. 11th January, 1957. (841689.)

1932. Marconi Instruments, Ltd.—Therionic valve circuit arrangements. 30th September, 1957. (842113.)

3309. British Thomson-Houston Co., Ltd. -High voltage electrodes. 16th January, 16th January, 1958. (842210.)

British Insulated Callender's Cables, Ltd.—Electric cable joints or terminations.
4th February, 1958. (840744.)
4210. Simon-Carves, Ltd.—Discharge

electrodes for electrostatic precipitators. 5th December, 1957. (840853.)

5381. Electric Storage Battery Co.— Storage battery electrodes. 18th February, 1957. (840979.)

6095. Thompson, R. F., and Breach, A. C. E.—Jointing individual cores of cables. 21st February, 1958. (841109.)

7451/2. General Electric Co., Ltd., Dredge, C. J., and Riches, E. E.—Electromechanical resonators. 6th March, 1958.

11386. Siemens Edison Swan, Ltd.—Magnetostrictive delay lines. 31st March, 1958. (841435.)

11625. Appareillage V.F.B.—Electro-magnetic circuit-breakers. 9th April, 1957. (841436.)

Telephone Manufacturing Co., Ltd.—Arrangements for providing two-way communication at intermediate points on a telephone circuit. 17th March, 1958. (842116.)

12718. Standard Telephones & Cables, Ltd.—Ferromagnetic devices. 18th April,

1957. (840749.)

1957. (840749.)
12735. British Thomson-Houston Co., Ltd.—Control of electric motor speed changing gear combinations. 18th April, 1958. (Cognate application 5442, 19th February, 1958.) (841585.)
12737. Licentia Patent-Verwaltungs-Gm.b.H.—Method of testing circuit-breakers.

18th April, 1957. (842117.) 12940. British Thomson-Houston Co., Ltd.—Analogue computers. 19th May, 1958. (842118.)

Co.—Electromagnetic Bristol 13341. relays. 26th April, 1957. (841214.)

relays. 20th April, 1957. (641214.)

18219. Western Electric Co., Inc.—Electrical apparatus for determining the fundamental frequency of a complex wave. 7th June, 1957. (841306.)

18230. Brown, Boveri & Cie. A.G.—Regular arrangement for lighting plants with buffer battery. 7th June, 1957. (841364.)

21444. Soc. d'Electronique et d'Automatisme.—Electric digital computers. 5th July, 1957. (841368.)

21898. Siemens & Halske A.G.—Telephone installation circuit arrangements for crossed-coil co-ordinate selectors having two coupling stages. 10th July, 1957. (841490.) 22198. General Electric Co., Ltd.—Elec-

tric pulse generating apparatus employing transistors. 9th July, 1958. (Cognate application 22199, 12th July, 1957.) (841307.)

22242. Siemens & Halske A.G.—Methods of heat treatment of a body consisting of semiconducting material. 12th July, 1957.

Sperry Rand Corporation.—Gating 23569. circuits employing magnetic amplifiers. 25th July, 1957. (841492.)

24318. General Electric Co.-Phase

detection. 31st July, 1957. (841161.)
25149. Cole, Ltd., E. K.—Electric fires.
4th November, 1958. (841222.)

26408. Canning & Co., Ltd., W.—Electro-deposition of nickel. 31st October, 1958.

26475. Sauer & Sohn G.m.b.H., J. P.— Eddy current dynamometers. 22nd August, 1957. (841493.)

26700. Standard Telephones & Cables, td.—Wide band waveguide circuitry. 23rd August, 1957. (841118.)

26963. Westinghouse Electric Corporation.—Air-break electric circuit interruptors. 27th August, 1957. (840901.)
27303. Radio Corporation of America.—Cathode-ray tubes. 29th August, 1957.

(841373.)28380.

Siemens Edison Swan, Ltd.— Register translator arrangements. 8th September, 1958. (841063.)

28720. Young, S. G.—Ceiling rose. 17th November, 1958. (841078.) 29425. Dimitri, I. R.—Electrical connec-

tors. 18th September, 1957. (841377.) 29649. Philips Electrical Industries, Ltd.

Frequency control systems. 20th September, 1957. (841378.)

29979. Pecazaux, M. F., and Kreuner, R. E.—Automatic thermal time delay switch. 24th September, 1957. (841035.)

30008. General Electric Co., Ltd., and Glover, B. W.—Magnetic amplifiers. 24th September, 1958. (841064.)

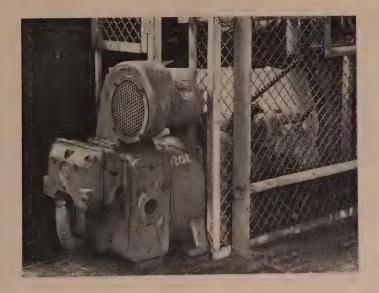
[Continued on page 249

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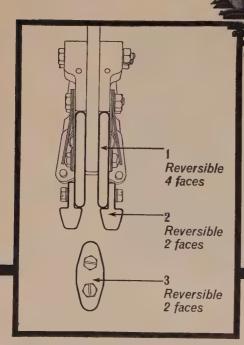
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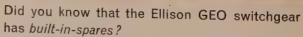
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NEW PATENTS (continued)

30544. General Electric Co., Ltd.—Electric contacts. 16th September, 1958. (840754.)

33608. Svenska Relafabriken A.B.-Auto-

33608. Svenska Keiarabriken A.B. Automatic telephone system with paging equipment, 28th October, 1957. (840939.)
34487. M-O Valve Co., Ltd., Dix, C. H., Jenkins, R. O., and Russell, C. R.—Travelling wave tubes. 19th November, 1958.

36021. Metropolitan-Vickers Electrical Co., Ltd.—A.c. traction equipments. 14th November, 1958. (840826.)

36866. Siemens & Halske A.G.—Wateright and pressure resistant leads-in for coaxial telecommunication submarine cables. 26th November, 1957. (Addition to 828844.)

37649. British Insulated Callender's Cables, Ltd.—Overhead electrification systems for railways. 2nd December, 1958. (841090.)

37933. Tuchel, U.—Flexible electric contact elements and assemblies incorporating same. 5th December, 1957. (840860.)

1396. Demag-Elektrometallurgie G.m.b.H.—Electric melting furnaces. 15th January, 1958. (841176.)

3380. Racal Engineering, Ltd.—Electronic bi-stable trigger circuits. 2nd February, 1959. (840786.) circuits. 2nd February,

4077. Standard Telephones & Cables, Ltd.—Pulse delay circuit. 7th February, 1958. (840787.)

5390. General Electric Co.—Apparatus for printing colour codes on lengths of wire. 19th February, 1958. (841404.)
5714. Standard Telephones & Cables, Ltd.—Sealing a metallic vessel containing an electric component. 21st February, 1958. (841180.)

5799. Licentia Patent-Verwaltungs-G.m.b.H.—Holders for electric discharge lamps. 21st February, 1958. (840833.)
6564. Biegelmeier, G.—Protective circuit-breakers. 28th February, 1958. (841181.)

6721. Rowenta Metallwarenfabrik G.m.b.H.—Electric steam irons. 3rd March, 1958. (841124.)

6798. Ericsson Telephones, Ltd.—Pulse checking circuits. 23rd February, 1959. (841498.)

7620. Hazeltine Corporation.—Electronic previewer for negative colour film. 10th March, 1958. (841125.)

Siemens-Schuckertwerke 7748. Siemens-Schuckertwerke A.G.—all voltage generators. 11th March, 1958. (841445.)

9729. United States Atomic Energy Commission.—Boiling water reactor. 26th March, 1958. (840789.)

10031/2/3. Westinghouse Electric Corporation.—Electric motor control apparatus. 28th March, 1958. (841503/4/5.)
13116. M-O Valve Co., Ltd.—Electron gun assemblies. 11th February, 1959. (841130.)

16826. Felten & Guilleaume Carlswerk A.G.—Flexible submersible repeater for submarine cables. 27th May, 1958. (840997.)

17412. Chuchla, J. K.—Electromagnetic relays. 30th May, 1958. (841931.)

18103. United States Atomic Energy Commission.—Thermonuclear reactor. 6th June, 1958. (841792.)

20137. Nilsson, N. O.—Method and means for mounting tubes for electrical installation. 24th June, 1958. (841794.)

20928. Sylvania Electric Products, Inc.— Light amplifier and storage device. 30th June, 1958. (842188.)

21563. Reich, E., and Koreny, A.—Ele trical connector. 4th July, 1958. (841936.) A.—Elec-

23571. Smit & Co.'s Transformatoren-fabriek N.V., W.—Polyphase tap changing switching devices for use in combination with regulating transformers. 22nd July, 1958. (841938.)

Philips Electrical Industries, Ltd. 25529. —Magnetic storage systems. 8th August, 1958. (841669.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 20th August:

Gayspin. No. B788,836. Spin-Gay. No. 788,837. Class 7. Washing machines and drying machines and combinations thereof; thying machines and combinations thereof; centrifugal water-extracting machines, combined washing machines and centrifugal water-extracting machines; and parts.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Kingsway, London, W.C.2.

Ever Ready. No. 778,623. Class 9. Plugs, sockets and switches; electric covered wire, electric junction boxes and fuse boxes; and electric flat irons, kettles and coffee percolators. Ever Ready. No. 778,624. Class 11. Electric kitchen utensils; and electric hair drying appliances (not machines).—Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

Ampex. No. 780,067. Class 9. Apparatus and installations, all employing magnetic tape for recording and reproducing visual images, sound or other data; and apparatus and installations for use in remote control of machinery, scientific processes, chemical processes or the like by means of tape.—Ampex Corporation, Redwood City, Cal., U.S.A. Address for service, c/o Boult, Wade & Tennant, 112, Hatton Garden, London, E.C.I.

Sync Lock. No. 789,442. Class 9. Wave-

Sync Lock. No. 789,442. Class 9. Wave-form generators with provision for locking and phasing the line and field frequency pulses to Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, E.C.1.

Conduffor. No. 796,305. Class 9. Electric conduit materials and fittings.—Conduffor

Canada, Ltd., Toronto, Canada, Address for service, c/o A. M. & Wm. Clark, 5, Stone Buildings, Lincoln's Inn, London, W.C.2.

Interchrome. No. 797,590. Class 9. Scientific and electrical apparatus and instruments, etc.—Chrome-Alloying Co., Ltd., London Bridge House, London, S.E. 1.

Volaxial. No. 799,339. Class 9. Electrical apparatus and instruments and parts; radio and television apparatus and parts; and electric wires and cables. Volaxial. No. 799,340. Class 11. All goods included in Class 11.—Volex Electrical Products, Ltd., 37, Brown Street, Manchester, 2.

Cordacall. No. 799,410. Class 9. Electrical apparatus for recording and reproducing sound by means of magnetic tape, being goods incorporated in the circuits of telephone receiving instruments for automatically answering telephonic communications and recording telephonic messages in the absence recording telephonic messages in the absence of the subscriber.—K. S. Paul (Printing Machinery), Ltd., Great Western Trading Estate, Park Royal Road, London, N.W.10.

Wintermaster. No. B798,348. Class 10. Electric blankets.—G. W. Stead, Jocelyn Square, Glasgow, C.1.

Creda Sealatch. No. 798,254. Class II. Heating and cooking apparatus; refrigerating and drying apparatus; and parts.—Simplex Electric Co., Ltd., Creda Works, Grindley Lane, Blythe Bridge, Stoke-on-Trent.

Sunshine Nu-Brite. No. B802,725. Class 11. Incandescent electric lamps and electric lighting for Christmas trees and for similar decorative purposes.—Britannia Electric Lamp Works, Ltd., 17-21, Sunbeam Road, Chase Estate, London, N.W.10.

FORTHCOMING EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

WEDNESDAY, 24th AUGUST to SATUR-DAY, 3rd SEPTEMBER

London.—Earls Court. National Radio and Television Exhibition.

WEDNESDAY, 31st AUGUST to WEDNESDAY, 7th SEPTEMBER

Cardiff.—British Association for Advancement of Science. Annual meeting.

MONDAY, 5th SEPTEMBER to SUNDAY, 11th SEPTEMBER

Farnborough.—Royal Aircraft Establishment. 21st Flying Display and Exhibition.

TUESDAY, 13th SEPTEMBER to FRIDAY, 16th SEPTEMBER

Folkestone.—Leas Cliff Hall, Association of Public Lighting Engineers. Annual conference.

WEDNESDAY, 21st SEPTE SATURDAY, 1st OCTOBER SEPTEMBER

Manchester.—Belle Vue. Factory Equipment, Heating and Thermal Insulation Exhibition.

22nd SATURDAY, 24th SEPTEMBER

Cheltenham.—Queen's Hotel. Conference on the "Theory and Practice of Ultrasonic Inspection." Conference arranged jointly by the Institute of Physics Non-Destructive Testing Group, the Society of Non-Destructive Examination, and the Non-Destructive Testing Society of Great Britain.

MONDAY, 26th SEPTEMBER

Sutton Coldfield.—Finals of the Electrical Industries National Golf Championship.

TUESDAY, 27th SEPTEMBER WEDNESDAY, 28th SEPTEMBER

London.—I, Birdcage Walk, S.W.I. Symposium on Automatic Control. Sponsored

by the British Conference on Automation and Computation, and arranged by the Institution of Mechanical Engineers.

JESDAY, 27th SEPTEMBE THURSDAY, 29th SEPTEMBER

London.—Connaught Rooms. Department of Scientific and Industrial Research. Conference on "Ergonomics in Industry."

MONDAY, 3rd OCTOBER to SUNDAY, 9th OCTOBER

London.—Railway Electrification Conference at the Institution of Civil Engineers and Exhibition at Battersea.

THURSDAY, 6th OCTOBER

London.—Savoy Place, W.C.2. Institution of Electrical Engineers. Presidential address by Sir Hamish MacLaren.

P.O.A. Conference

The 1960 conference of the Purchasing Officers' Association will be held in Scarborough from 29th September to 1st October. The opening address will be given by Sir Edward Boyle, M.P., Financial Secretary to the Treasury, and there will be a paper on "The Effect on Purchasing of Amalgamations," by Mr. T. E. G. Baker, purchasing director of Albert E. Reed & Co., Ltd.

Further particulars of sectional meetings can be obtained from the Association at Wardrobe Court, 146a, Queen Victoria Street, E.C.4.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.-State Electricity Commission of Western Australia, Perth. 15th September. Six 10 MVA, 66/6.6 kV transformers. (E.S.B. 19131/60.)*

Burma.—Director General of Posts and Telegraphs, Rangoon. 22nd August. Telephone and telegraph multiplexing equipment. (E.S.B. 19138/60.)*

Burma Purchase Board, Rangoon. 15th ugust. Telegraph sounders and signalling

August. Telegraph sounders and signalling keys. (E.S.B. 19541/60.)* Lampholders and switches. (E.S.B. 19543/60.)*

Costa Rica.—La Proveeduria, Instituto Costaricense de Electricidad, San Jose. 19th August. Starters for three-phase electric motors. (E.S.B. 19603/60.)*

Croydon.—Corporation. 15th An Rewiring of electrical installation at Thornton School. (See this issue.)

Formosa.—Central Trust of China, Taipei 22nd August. T 18855/60/I.C.A.)* Telephone cable.

India.—Punjab State Electricity Board,

India.—Punjab State Electricity Board, Patiala. 14th September. Steel towers for Bhakra Nangal project. (E.S.B. 19502/60.)*
Rajasthan State Electricity Board, Jaipur. 8th August. Lightning arrestors, dropout fuses and isolating switches. (E.S.B. 19501/60.)* 9th August. Six earthing transformers. (E.S.B. 19503/60.)*
Madras State Electricity Board. 17th August. Porcelain fuse units and ironclad cut-outs. (E.S.B. 19562/60.)*

Leag.—Ministry of Industry Baghdad

Iraq.—Ministry of Industry, Baghdad. 6th September. Equipment for overhead lines and underground cables. (E.S.B. 18875/60.)*

Iran.—Sugar Factories of Iran, Teheran. 25th September. Underground cables. (E.S.B. 19564/60.)*

Korea.—Government Office of Supply, Seoul. 22nd August. Electrical equipment. (E.S.B. 19189/60/I.C.A.)*

Longbenton.-U.D.C. Street lighting equipment. (See this issue.)

Manchester.—Corporation. 15th August, Lighting equipment and auxiliary services at Davyhulme sewage works extensions. (See this issue.)

New Zealand.—Hamilton City Council. 25th August. Underground cable. (E.S.B. 19570/60.)*
New Zealand Electricity Department, Wellington. 25th October. 20 MVA, 11 kV voltage regulating transformers. (E.S.B. voltage re; 19577/60.)*

Nigeria.—Electricity Corporation of Nigeria. 20th August. 250 kW diesel driven alternator set and water cooler. (E.S.B. 19155/60.)*

North Shields.—Coquet Water Board. 19th August. Electrical installation at filtration works and pumping station, Warkworth. (See this issue.)

Pakistan.-Directorate General, Posts and Telegraphs, Karachi. 31st August. One or two 50 kW to 60 kW diesel driven generating sets. (E.S.B. 19141/60.)*

Staveley.—U.D.C. 27th August. Group "A" street lighting equipment. (See this issue.)

This information is extracted from Board of Trade Export Service Bulletin. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

Thailand.-State Railways, Bangkok. August. Ironclad batteries for train lighting. (E.S.B. 19171/60.)*
Provincial Electricity Organisation. 10th

August, Aluminium conductor and accessories. (E.S.B. 19532/60.)* 16th August. Insulators and eye bolts. (E.S.B. 19531/60.)*

ORDERS PLACED

London.—Islington Estates Committee. Recommended. Installation of power circuits and renewal of lighting circuits, Halton Man-

and renewal of lighting circuits, Halton Mansions (£13,305).—Evans & Shea.
Paddingson Works Committee. Recommended. Lamp columns and equipment required in connection with street lighting conversion programme from gas to electricity, 1960-61 (£7,810).—Engineering & Lighting Equipment Co.

Newcastle-on-Tyne.—City Council. Supply of 293 colour corrected mercury vapour lanterns and control gear (£3,636).—General

Norwich.—City Council, Renewal of the wiring and lighting installation in St. John Andrew's Hall (£3,234).—Johnson, Pearce &

Oxford.—Regional Hospital Board. trical installation work in connection with Stage 11 of the construction of the new Princess Margaret Hospital, Swindon (£127,918).—F. H. Wheeler & Co.

Scunthorpe.—Corporation. Recommended. Electrical installations in shops and flats at Healey Road (£1,027).—Hobson & Hammond (Electrical).

Torquay. — Corporation Entertainments and Marine Spa Committee. Electrical installation work at the Princess Theatre (£8,425).—W. G. Heath & Son.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Acton.-Works extensions; Carltona, Ltd., Victoria Road North.

Aylsham.—Old people's home (£71,000); county architect, 27, Thorpe Road, Norwich.

Barnet.—Houses (51), Arkley; Barkwell Development Co., Ltd., 41, Upper Berkeley Street, London, W.I.

Barnsley.—Workshop, canteen, administrative accommodation, etc., at the handicapped persons' centre (£60,000); borough surveyor, Town Hall.

Barry. — Teachers' training college (£475,000); E. A. E. Evans, architect, County Hall, Cathays Park, Cardiff.

Basildon.—Hostel for (£67,000); H. Conolly, County Hall, Chelmsford. for elderly county architect,

Coatbridge.—Extensions to St. Patrick's High School (£464,000); county architect, 34, Albert Street, Motherwell.

Corby.—Block of flatlets for old people (£36,000); county architect, Northampton.

Cumberland. — Comprehensive Egremont (£500,000); county architect, Portland Square, Carlisle.

Enfield.—Works extensions; Tobex Paint Co., Ltd., Southbury Road.

Greenford.-Baptist church, Oldfield; H. H. Clark, architect, 3, Clements Inn, London,

Harrogate.—Office block, Victoria Avenue; Walter G. Birch, Ltd., Montpelier House.

Hull.—Office block, Ferensway; Allanson Hick, architect, 4, Bond Street.

Ilford.—Six blocks of three-storey The Glade; borough engineer, Town Hall.

Isleworth.—Adult training centre, Acton Lodge Grounds; Middlesex county architect, I. Queen Anne's Gate Buildings, London,

Keighley.-Ten-storey flats, Hainsworth Wood estate; borough architect.

Lancashire.—College of music, Manchester area (£300,000); county architect, County Offices, Preston.

Lancing.—Bungalows (92), Alexandra Park estate; Millview Estates, Ltd., 8, South Street.

Leicestershire.—Second instalment of grammar school, Hinckley (£227,740) and county school, Groby (£40,500); county architect, Leicester.

Leigh (Lancs.).—Flats (32), Siddow Common; Housing Department, Windermere Road.

Llwchwr.—Seventeen blocks of dwellings, Loughor, Gowerton and Gorseinon; clerk, Council Offices, West Street, Gorseinon, Swansea.

London.—New buildings for Dame Alice Owens School, Owen Street, Finsbury; Marshall, Andrew & Co., Ltd., 40, Broad-way, S.W.I. Offices, Foubert's Place, Mayfair; Ronald Ward & Partners, architects, 29, Chesham Place, S.W.I.

Ward & Par Place, S.W.I.

Houses (137), Sydenham Park Road, Sydenham Park and Longfield Crescent, Lewisham; borough engineer, Town Hall,

Catford, S.E.6. Loughborough.-Houses, Ashby Pinfold Street, Rectory estate and Hathering (139); borough surveyor.

Louth.—Science block at King Edward VI bys' Grammar School; county architect, Lincoln.

Lowestoft.—Block of offices; E. J. Cundliffe, county architect, County Hall, Ipswich.

Neath.—Houses (104), Caewern site; J. T. Jones, surveyor, Orchard Chambers, Orchard Street, Neath, Glam.

Newcastle-on-Tyne.-College of Further Education (£750,000); city architect, 18, Cloth Market, Newcastle.

Oxford.—Law library for University; Sir Leslie Martin, architect, The King's Mill, Great Shelford, Cambridge.

Plymouth.—R.C. church, Armada Way; Sir Giles Scott, Son & Partner, architects, 9, Gray's Inn Square, London, W.C.1.

Purfleet.—Works extensions, Thames Board Mills, Ltd.; Fredk. S. Snow & Partners, consulting engineers, 144, Southwark Street, London, S.E.1.

Ross-on-Wye.—Factory; Woodville Rubber Co., Ltd., Burton Road, Swadlincote.

Rugby.—Milk distribution depot on site at rear of Benn Street; Midland Counties Dairy Co., Ltd., Gulson Road, Coventry.

Salisbury.—Flats (58) and six houses, West Harnham; city engineer, The Council House.

Spalding.—Flats, Windsor estate (£55,000); U.D.C. surveyor.

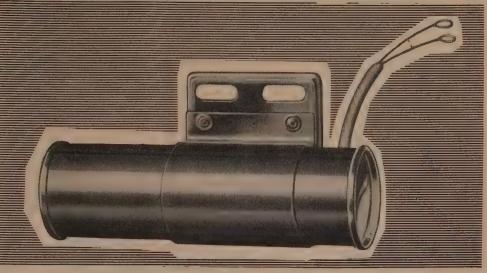
Stevenage.—Factory; Bowater Packaging, Ltd., Bowater House, Knightsbridge, London, S.W.I.

Sunderland.—Old people's bungalows (100), for the R.D.C.; C. Emmerson, surveyor, Esplanade, Sunderland.

Welwyn Garden City.—Dwellings (262); harles W. Fox, architect, N.P. Bank Chambers.

Wembley.—Additional factory; Clearex Products, Ltd., Heather Park Drive. Methodist church, Park Lane; Thomas F. Ford & Partners, architects, 189, Victoria Street, London, S.W.I.

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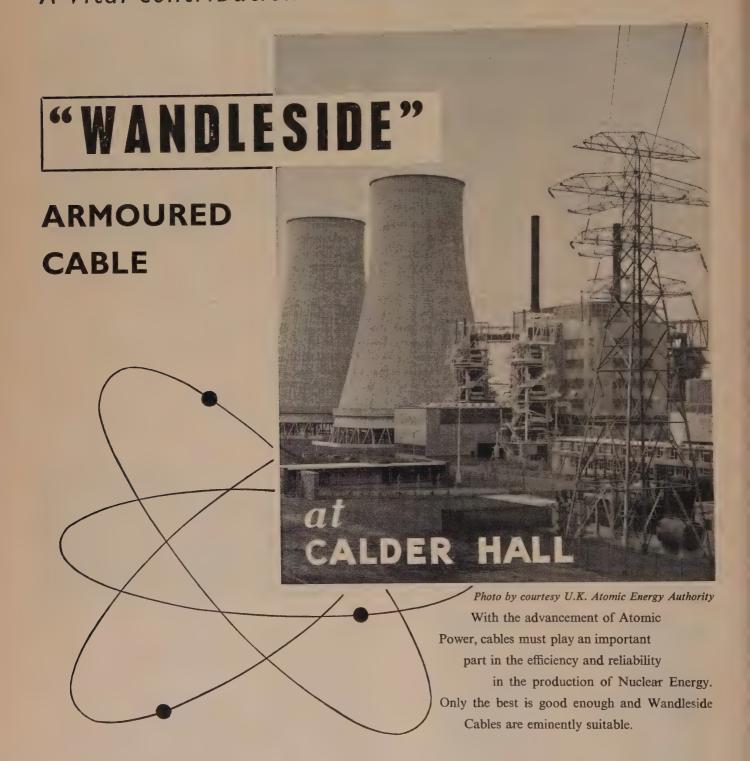
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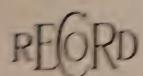
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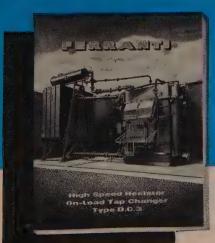
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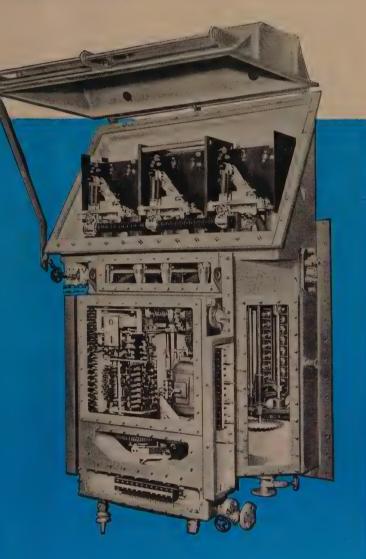
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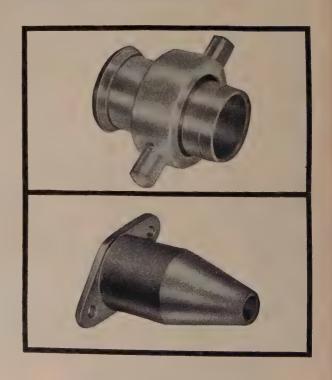
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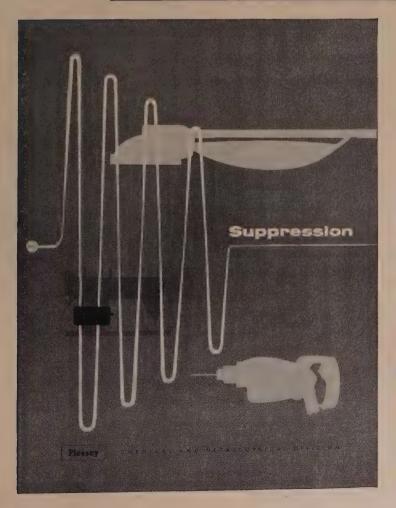
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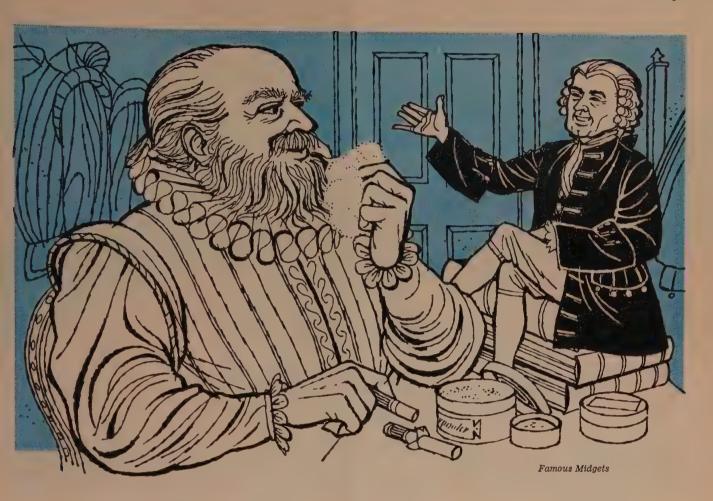
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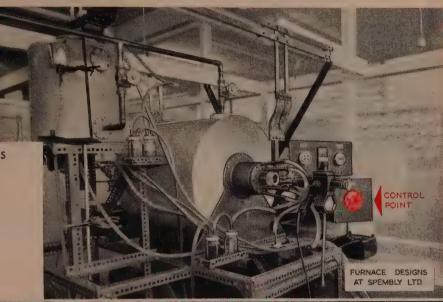
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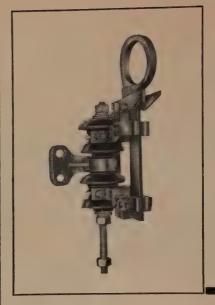


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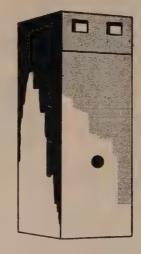


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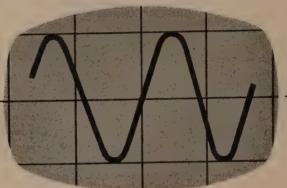
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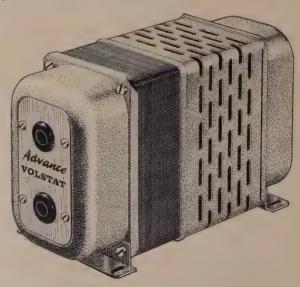
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CVH 750A	190-260 50~	240	750	1.00	£68 0 0	
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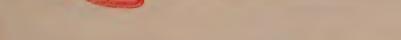
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Motor Generator Repairs and Rewinds. Industrial and Crane Installations.
Power, Heating and Lighting, Factory Maintenance. Breakdown Specialists.
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Industrial Installations throughout the Country. Power, Maintenance and Insurance

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Telephone: EUSton 3763 Electrical Engineers and Contractors

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Electrical Engineers and Contractors Telephone: ENField 6612 (3 lines)

T. A. BOXALL & CO.
(London Address to be announced later)
20 Balcombe Road, Horley
Telephone: Horley 4388
Electrical Engineers and Contractors
Home

Home and Overseas

F. W. BLANSHARD LTD.

23 Lansdowne Road, Purley, Surrey

Telephone: Uplands 4818, 4819 & 4810

Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent

SERVICE ELECTRIC CO. LTD.
Secomak Works, Honeypot Lane, Stanmore, Middx.
Telephone: EDGware 5566-7-8-9

Electrical Installations of every kind. Motor Rewinds. Factory Maintenance

DYNAMO & MOTOR REPAIRS LTD. North End Road, Wembley Park

Telephone: Wembley 3121

Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

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Telephone: Brighton 23201-2-

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Electrical, Refrigeration and Radio Engineers. Lifts. Television Installation Contractors

H. BENEY & SONS LTD. 99 South Street, Eastbourne Telephones 4820/I (Day and Night)

For first-class A.C. and D.C. Rewinds and Industrial Plant Maintenance

ELECTRICAL POWER REPAIRS (Gillingham) LTD. Strover Street, Gillingham, Kent

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Gravesend 22 Parrock Street Phone: Gravesend 4139

Gillingham 20 Rock Avenue Phone: Gillingham 50629 **Electrical Installations**

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Heavy engineering and electrical contracting for farm, factory and estate

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Telephone: 55531 (10 lines)
Refrigeration. Repairs. Oil heating and drying installations

F. W. BLANSHARD LTD. 23 Lansdowne Road, Purley, Surrey Telephone: Uplands 4818, 4819 & 4810

Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent

R. & B. SIMS

28 The Broadway
New Haw, Weybridge, Surrey
Telephone: BYFLEET 2218
Wiring Installations, Refrigeration Engineers, Lighting Consultants,
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Telephone: Woking 1157

Electrical Contractors and Floor Heating Specialists

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Dynamo & Motor Repairs. Rewinds AC & DC up to 200 hp. Installations. Factory Maintenance
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63 St. Denys Road, Southampton
Works: 34 Spear Road, Southampton
Established 1919
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Telephone 54279
Telephone 21626

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
32 Brassey Road, Winton, Bournemouth

Telephone: Winton 1609

F. H. WHEELER (Southern) LTD. Clifton Hall, Oakley Road, Shirley, Southampton one 73867 & 76056

GOATER & MEDWAY LTD.

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Telephone 28980
Cable Jointing. Cable Laying. By Direct Contract and to the Trade.

SOUTH WESTERN

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F. H. WHEELER (Bristol) LTD.
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Motor, generator and transformer rewinds. Lighting and power installations.
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CLARKE BROS. (Stroud) LTD.

Bath Road, Stroud
Telephone: Stroud 1132/3
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EASTERN

Public Lighting Contractors and Electrical Engineers

BRIGG ELECTRICAL CO. LIMITED Wrawby Street, Brigg, Lincs. Telephone: Brigg 2349 & 2340

Norwich....Cambridge....Gt. Yarmouth....Lowestoft....Ipswich
EASTERN & HOME COUNTIES ELECTRICAL CONTRACTORS

Specialists in Large Scale Electrical Installation Contract Electra House, Southtown Road, Gt. Yarmouth Telephone: Gt. Yarm. 2390

EAST MIDLANDS

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C. A. J. BILLINGTON LTD.

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Industrial Installation throughout the Home Counties

Public Lighting Contractors and Electrical Engineers

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For all types of Electrical Installations
W. J. FURSE & CO. LIMITED
Traffic Street, Nottingham
Telephone: 83471 (5 lines)

Electrical Engineering Contracting Specialists

MIDLANDS

WALKER BROS. (ELECTRICAL ENGINEERS) LTD.

Contracts Dept., 12-13 Bath Street, Birmingham 4
Telephone: NORthern 5288
Electrical Intallation Engineers. Industrial Installation Specialists
Established 1895

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For all electrical contracting installations, lighting, heating, power, public address, etc.

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THE BIRMINGHAM POWER TRANSMISSIONS LTD.
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DYNAMO & MOTOR REPAIRS LTD.

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Motor and generator repairs and rewinds. Installations and factory maintenance.
Electrical plant stockists

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Industrial Electrical Work of All Kinds. Over 40 Years' Experience

FRANCE'S ELECTRIC LTD. Darlaston, Staffs.

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For all types of Electrical Installations
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Traffic Street, Nottingham
Telephone: 83471 (5 lines)
Electrical Engineering Contracting Specialists

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DRAKE & GORHAM (Contractors) LTD.
13 St. Andrew's Crescent, Cardiff
Telephone: Cardiff 32080

Electrical Engineers and Contractors

. . for all electrical installations

F. H. WHEELER & CO. LTD. 117 Woodville Road, Cardiff Telegrams: "Whelect"

Telephone 21281-2

CLARKE BROS. (Stroud) LTD.
High Street, Merthyr Tydfil
Telephone: Merthyr Tydfil 3377
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

W. J. FURSE & CO. (MANCHESTER) LTD.
Royal Buildings, Talbot Road, Port Talbot
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For Electrical Installations and Contract Work

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Electrical Engineers and Contractors for over 50 years

TROUGHTON & YOUNG LTD.
46 Rodney Street, Liverpool I

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Telephone: Liverpool Central 1729
Electrical Engineers and Contractors

Electrical Engineers and Contractors since 1919 SPEEDS (Widnes) LIMITED 2-4-6 Appleton Village, Widnes, Lancs. Telephone: Widnes 2471-2-3

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SOUTHERN & REDFERN LTD.
Woodhead Road, Bradford 7

Textile Maintenance, Repairs and Rewinds Telephones: Bradford 23871—Late Phone: Bradford 65837

GREEN & SMITH LTD.
Albert Works, Meadow Lane, Leeds II
Telephone 20834-5-6
Industrial and Commercial Installations. Motor Sales and Repairs.
Electrical Floor Heating and Air Conditioning, etc.

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F. H. WHEELER & CO. LTD. 44 Bank Street, Sheffield I

Telegrams: "Whelect" Telephone 24015 (3 lines)

(Continued on page 74)

(Continued from page 73)

NORTH WESTERN

STEWART THOMSON & SONS (Liverpool) LTD. Fort Road, Seaforth, Liverpool 21

Repairs and Rewinds A.C. and D.C. to 3,000 horsepower.
Urgent Repairs, etc. 24-hour service
Telephone: Bootle 2697-8 Breakdowns.

DRAKE & GORHAM (Contractors) LTD. 21 Newton Street, Piccadilly, Manchester I

Telephone: Manchester Central 4701 Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
Regal Buildings, Oxford Road, Manchester I
Telephone: Central 8207-8

Industrial Installation

W. H. SMITH & CO. ELECTRICAL

Contracting
1 York Street, Manchester 2

CENtral 2991-8

DENton 3961

Manufacturing
Shepley Estate, Audenshaw
DENton 3961

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Electrical Contractors of repute since 1880. Motor Rewinds and Manufacturing
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Telephone: 66277/8

Engineers and Contractors

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Turks Head Yard, Cecil Street, Lincoln
Telephone: Lincoln 124 London: HOLborn 9722

FAIRBAIRN & PARTNERS (Newcastle) LTD. 60 Lovaine Place, Newcastle-upon-Tyne I

Telephone: Newcastle 2-1052 Electrical Engineers and Contractors

JAMES SCOTT & CO. (ELECTRICAL ENGINEERS) LTD.

Argyle House, Argyle Street, Newcastle-upon-Tyne I
Telephone 28605
Britain's Largest Electrical Installation Organisation for all high-class Electrical
Installation and Instrumentation

for all electrical installations

F. H. WHEELER & CO. LTD. 52 Elswick Road, Newcastle Telephone: Newcastle 36271

SOUTH WEST SCOTLAND JAMES SCOTT & CO. (ELECTRICAL ENGINEERS) LTD. 80/110 Finnieston Street 21/25 George IV Bridge

Glasgow, C.3

Felephone: Central 3866

Telephone: Central 6424

Britain's Largest Electrical Installation Organisation for all high-class Electrical
Installation and Instrumentation

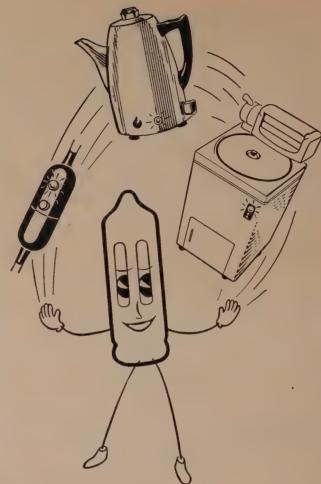
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Electrical Engineering Contractors A. G. BRUTY LIMITED 38 Dawson Street, Dublin Telephone: Dublin 73181

Applications for particulars of costs and standard style of advertisements in this Regional Guide should be addressed to:

THE

ADVERTISEMENT DEPARTMENT, ELECTRICAL REVIEW. DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1



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Because this Hivac wire-ended Neon Indicator can be directly wired into almost every type of domestic electric appliance, it makes the appliance more convenient, more economical and more attractive to your customers.

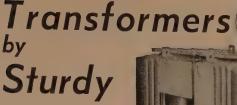
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- No filament to break
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- Operation on wide range of AC or DC voltages

For details of the range of Hivac Neons, write to:



Stonefield Way, South Ruislip, Middlesex. Viking 1288



FROM 500 VA TO 200 kVA

REGULARLY SUPPLIED TO NATIONAL COAL BOARD, CENTRAL

ELECTRICITY GENERATING BOARD, AND MANY OTHER LARGE INDUSTRIAL UNDERTAKINGS

Typical 200 kVA **Transformer**

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FOR FINGER-TIP MANUAL OR AUTOMATIC CONTROL OF POWER UP TO 500 kVA

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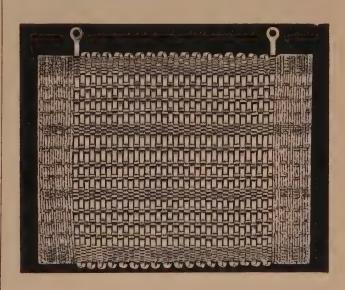




Credit Pattern and Prepayment Type 200-240 v. A.C. S/Ph 50c. (& D.C.) AVAILABLE FROM STOCK POLYPHASE 400-440 v. 3-wire Type Ex Stock UNIVERSAL ELECTRICAL CO. 217-221 City Road, London, E.C.1



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Asbestos woven Regulators, loading or heating grids, manufactured in a wide range of sizes to suit customers' particular requirements. End or immediate tappings either lugs or requirements. End or immediate flexible leads. Write for List No. 140.

Also makers of :-

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Ferrule or wire end type. $1\frac{1}{2}$ — 250 watts.

Full range of 24 sizes -List V.E. 190.



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Telephone WILLENHALL 494 · 495 · Grams WILOHM WILLENHALL LONDON OFFICE: HERGA WORKS, WALLINGFORD RD., UXBRIDGE, MIDDX.

UXBRIDGE 5211



Weir

DE-AERATORS

eliminate oxygen corrosion in the power plant

Prolong life of boiler tubes, economisers, valves and other surfaces.

Heat in operating steam retained in feed water.

The Weir triple De-aerators illustrated are mounted on a feed tank 35 feet long, 12 feet 6 inches diameter, and have a normal output of 1,300,000lb,/hr. at 280°F.

We invite enquiries for the most suitable equipment to meet specified requirements.



G. & J. WEIR LTD., CATHCART, GLASGOW, S.4



Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx, 6 words).

DISPLAYED CLASSIFIED: -48/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:-13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

OFFICIAL NOTICES, TENDERS, ETC.

THE COQUET WATER BOARD

Filtration Works & Pumping Station, Warkworth

Lighting, Heating and Power Circuits: Contract No. 15

TENDERS are invited for the INSTALLA-TION OF LIGHTING, HEATING AND POWER CIRCUITS at the above works as

- (i) A complete installation of lighting circuits including provision of the lighting fit-
- (ii) A complete installation of off-peak heaters including provision of storage type heaters
- (iii) A complete installation of an under-floor
- heating system in a portion of the works.

 (iv) Provision and installation of 15-ampere socket outlets.

Specifications may be obtained on application to Mr. S. G. Barrett, M.I.C.E., Engineer and Manager, The Coquet Water Board, P.O. Box 104, Pilgrim Street, Newcastle upon Tyne, 1, on payment of a £2 2s. deposit, which will be refunded only on receipt of a bona fide

Tenders to be returned in the envelope provided to the undersigned not later than to a.m. on Friday, 19th August, 1960.

The Board do not bind themselves to accept

the lowest or any tender.

F. G. EGNER, Clerk and Solicitor to the Board.

14, Northumberland Square, North Shields.

STAVELEY URBAN DISTRICT COUNCIL

Tender for Group "A" Lighting Scheme in Sodium

TENDERS are invited for the supply and Lerection of approximately 56 complete lighting installations, including concrete columns, lanterns, auxiliary gear, cable laying, etc., on the main A.619 Worksop Road, in the Urban District.

District.
Forms of tender, specification, bill of quantities and conditions of contract (the Institution of Electrical Engineers' model form) are obtainable from the Engineer and Surveyor, and the plan may be inspected at his office, Council Offices, Lowgates, Staveley, Nr. Chesterfield.
Tenders endorsed "Worksop Road Lighting Scheme" must be sent so as to reach me not later than Saturday, the 27th August, 1960. The Council do not bind themselves to accept the lowest or any tender.

the lowest or any tender.

HAMILTON H. STANLEY, Clerk of the Council.

Council Offices, Lowgates, Staveley, Nr. Chesterfield.

CITY OF MANCHESTER

Davyhulme Sewage Works Extensions

TENDERS are invited for the supply, delivery and erection of the Lighting Equipment and auxiliary services for the Primary Sludge Digestion Plant.

Tender documents, to be returned by 9.30 a.m. on 5th September, 1960, obtainable after 15th August, from the City Surveyor, Town Hall, Manchester, 2.

LONGBENTON URBAN DISTRICT COUNCIL

Public Lighting

Conversion from Gas to Electricity (Group I)

TENDERS are invited for the supply and A erection of 133 Sodium Vapour Street Lighting units on main roads and 21 100-watt Filament Lighting units on other roads, as

- West Moor corner to Killingworth Station.
 Burradon-Dudley via Weetslade Road to district boundary at Dudley.
 Coach Lane, Hazlerigg.
 Glebe Road to Great Lime Road, Forest

Plans can be inspected at the office of the Engineer and Surveyor and specification, schedule and forms of tender can be obtained on application to Mr. A. E. Sweetman, M.I.Mun.E., Engineer and Surveyor, Council Offices, Forest Hall, Newcastle upon Tyne, 12, on payment of a deposit of £3 3s., returnable only on receipt of a bona fide tender not subsequently withdrawn and the return of all documents loaned.

Tenders in plain sealed envelope endorsed

Tenders, in plain sealed envelope, endorsed "Public Street Lighting," must be delivered to the undersigned not later than 24th August,

The Council do not bind themselves to accept the lowest or any tender and reserve the right to divide the contract should they so desire.

G. HARRISON, Clerk of the Council.

5503

COUNTY BOROUGH OF CROYDON

Rewiring

TENDERS are invited for Rewiring the Electrical Installation at the West Thornton School, Boston Road.

Application should be made to the Borough Engineer, Town Hall, Croydon, for specification, drawings and tender form.

Closing date for tenders, 15th August, 1960.

E. TABERNER,

Town Clerk. 5475

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

Engineering Draughtsman required in the Electrical Engineer's Drawing Office at Divisional Headquarters, Birmingham.

Applicants should have suitable technical training and be capable, under supervision, of preparing detail drawings in connection with the construction of high-voltage substattions.

Salary will be in accordance with either Grades 14, 15 or 16, Class BX of the N.J.B. Agreement within the ranges £615-£830, £570-£785 or £570-£725, according to qualifications experience

and experience.

Applications, quoting Vacancy No. 202/60MD, should be submitted on the official form AE6, which may be obtained from the Bstablishments Officer, Central Electricity Generating Board, Midlands Division, 53, Wake Green Road, Moseley, Birmingham, 13. Closing date for receipt of applications, 19th August, 1960.

5482

Advertisements are accepted up to first post on Monday of the week of issue

If displayed with boxed rules, name or symbol block by **Friday** prior to week of issue

All communications to be addressed to: Classified Advertisement Department, ELECTRICAL REVIEW Dorset House, Stamford Street London, S.E.I

Original testimonials should not be sent with applications for employment

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

A SSISTANT CHEMIST

A (Ref. No. ER106/60)
required to assist the Group Chemist, based at Plymouth. Superannuation scheme. Salary N.J.B. New Class AX, Grade 11, Scale 7, £735-£.930 per annum.

Candidates must have ability to work independently and possess H.N.C. or equivalent qualification.

Duties will be mainly analytical but will include investigations of chemical problems throughout the Group. Knowledge and experience of power plant chemical problems essential and a knowledge of metallurgy will be considered an advantage.

Closing date 12th August, 1960.

ASSISTANT BLECTRICAL MAINTENANCE ENGINEER (Ref. No. ER.104/60)

ASSISTANT MECHANICAL MAINTENANCE ENGINEER (Ref. No. ER.105/60)

required at Hinkley Point Nuclear Power Station. Superannuation scheme. Salary N.J.B., provisionally within Scale 15, £1,445 - £1,605 per

annum.

Applicants should have served a recognised apprenticeship and have had experience in power station maintenance. Corporate membership of the appropriate professional institution would be an advantage.

Closing date 16th August, 1960.

Applications, quoting appropriate reference number, on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by the date stated.

5505

CENTRAL ELECTRICITY GENERATING BOARD

Research and Development Department

Analyst, Chemistry Division

A PPLICATIONS are invited for an appointment as an ANALYST in the Chemistry Division of the Central Electricity Research Laboratories, Leatherhead, for work on materials used in conventional and nuclear power stations. There will be an opportunity to take charge of a general analytical laboratory in two to three years' time.

Possession of a Degree in Chemistry or an equivalent qualification is essential, together with some industrial or postgraduate research experience. There are also vacancies for junior staff.

Applicants should be under 26 years of age. Salaries, up to £1,130 (or higher in exceptional cases) will be fully commensurate with experience, ability and qualifications, and excellent prospects exist for promotion to higher

Assistance may, under certain conditions, be given with housing.

Applications stating age, qualifications, experience, present position and salary to the Personnel Officer, 24/30, Holborn, London, E.C.1, by 22nd August. Envelopes should be marked "Confidential Ref. ER/274." 5462

Situations Vacant (continued)

NORTH EASTERN ELECTRICITY BOARD

Chief Commercial Officer's Department, Carliol House

A PPLICATIONS are invited for the following appointment:—

SALES STAFF TRAINER.

SALES STAFF TRAINER.

Applications are invited from persons having the ability to give instruction in sales technique to employees engaged in selling electrical appliances. Applicants should have had experience in retail selling and/or a wide experience in sales training. The person appointed will be expected to assist in the administrative arrangements and development of sales training courses and instruct at basic courses to sales reamanship and more specialised courses on different types of appliances. The possession of an O.N.C. in Electrical Engineering or a City and Guilds Installation Certificate would be an advantage.

City and Guilds Installation Certificate would be an advantage.

Salary will be in the range of £1,250 to £1,350 according to qualifications.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box 117, Carliol House, Newcastle upon Tyne, within ten days of the date of this advertisement.

5498

EASTERN ELECTRICITY BOARD

A PPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

SUB-AREA HEADQUARTERS, BEDFORD (194/60.R.ER)

FOURTH ASSISTANT ENGINEER (Planning and Development). Candidates should have had a sound technical training and experience in the planning and construction of large urban and rural distribution systems, including substations, at voltages up to 11 kV.
Salary N.J.B. Class L., Grade 13 (£845-£930).
Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend Street, Bedford, by 19th August, 1960, quoting the above reference number in full.

LUTON DISTRICT (195/60.R)

DISTRICT COMMERCIAL ENGINEER. The successful candidate will be responsible to the Manager of the District for all commercial aspects of a large District having an important industrial, agricultural, commercial and domestic consumer population. Candidates should have wide practical experience and be capable of dealing with problems arising from electrical contracting and maintenance, tariffs, rural and industrial extensions, the management of shownooms, retail selling and all aspects of service to consumers.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary N.J.B. Class J, Grade 3 (£1,445-£1,605). DISTRICT COMMERCIAL ENGINEER.

Apply by letter to the Manager, Luton District, Eastern Electricity Board, 487, Dunstable Road, Luton, by 19th August, 1960.

Essex Sub-Area

Essex Sub-Area

SUB-AREA HEADQUARTERS,
Nr. BRENTWOOD (196/60.N)

THIRD ASSISTANT ENGINEER (Construction). Candidates should have had a sound technical training and experience in the construction of substations, the erection of overhead lines and the laying and jointing of underground cables at voltages up to 33 kV. Graduate Membership of the Institution of Electrical Engineers would be an advantage.

Sallary N.J.B. Class L, Grade 10 (£1,010-£1,130) plus London allowance.

Apply by letter to G. M. Holland, M.I.E.E.,

Apply by letter to G. M. Holland, M.I.E.E., A.M.B.I.M., Engineer, Essex Sub-Area, Eastern Electricity Board, Millfield, Bentley, Nr. Brent-wood, Essex, by 19th August, 1960.

CHELMSFORD DISTRICT (197/60.R)

DISTRICT COMMERCIAL ENGINEER. Candidates should have a sound knowledge of electricity supply tariffs and the utilisation of electrical energy in industrial, commercial and domestic premises, and a good general experi-

ence of installation and contracting work, retail selling, showroom management and all aspects of service to consumers. Corporate Membership of the Institution of Electrical Engineers or possession of an equivalent qualification in electrical engineering would be an advantage.

Salary N.J.B. Class F, Grade 4 (£1,080-

L. Apply by letter to the District Manager, D. H. Walker, Esq., A.M.I.E.E., Eastern Electricity Board, Anchor Street, Chelmsford, by 19th August, 1960.

Norfolk Sub-Area

GREAT YARMOUTH DISTRICT

GREAT YARMOUTH DISTRICT

(a) THIRD ASSISTANT ENGINEER

(199/60.R).

(b) FOURTH ASSISTANT ENGINEER

(198/60.R).

Candidates for (a) should have had experience in operation and maintenance of H.V. and L.V. overhead and underground systems, including substations, and in fault location and protection.

Candidates for (b) should have had sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

substations.
Salary N.J.B. (a) Grade 9 (£845 - £930);
(b) Grade 11 (£745 - £830).
Apply by letter to the District Manager,
Eastern Electricity Board, Regent Road, Great
Yarmouth, Norfolk, by 19th August, 1960.

Northmet Sub-Area SUB-AREA HEADQUARTERS, LONDON, N.14

GENERAL ASSISTANT ENGINEERS (Engineering Draughtsmen)

(Engineering Draughtsmen)

(a) Mains Drawing Office (Ref. 993)
(201/60.R).

(b) Substations Drawing Office (Ref. 956)
(200/60.R).

Candidates for (a) should have had training and experience in overhead line design, layout of associated equipment, survey and route plans, and underground and overhead mains records.

Candidates for (b) should have had a good technical training and experience in the layout of switchgear, transformers and associated equipment for outdoor and indoor substations up to 33 kV.

Salary N.J.B. (a) and (b) Grade 18 (£690-£785) plus London allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet House, Southgate, London, N.14, by 15th August, 1960.

BARNET DISTRICT (202/60.R)

DISTRICT COMMERCIAL ASSISTANT. Candidates should have had a sound training and experience in a commercial department of the electrical industry and be capable of estimating for and supervising installation work. A knowledge of space heating, water heating and traiffs is essential Salary N.J.C. Grade 3 (£780 - £880) plus London allowance.

Apply by letter to F. G. Bromley, B.Sc. (Hons.) Eng., M.B.I.M., M.I.E.E., Manager, Eastern Electricity Board, 7c, High Street, Barnet, Herts., by 17th August, 1960. 5496

POST OFFICE

(a) Assistant Engineer (At least 15 posts for men)

(b) Telecommunications Traffic Superintendent

(b) Telecommunications Traffic Superintendent (About 15 posts for men and women)

All pensionable. Age on 1.9.60: 17½ and under 23½ for (a), 24½ for (b); with extension for Forces Service, Overseas Civil Service, and (up to two years) established Civil Service.

Duties: (a) technical design and development of telecommunications equipment; (b) planning and management of telephone services.

Qualifications for (a) and (b): G.C.E. (or equivalent) in English Language and 4 other subjects, including 2 at "A" level obtained at same examination from Pure Mathematics, Applied Mathematics, Pure and Applied Mathematics, Physics, Chemistry. Selection by interview. interview

interview.

Salary (London, men): (a) £560 at 18, 19, 20, £620 at 21, £785 at 25 or over, rising to £1,205; (b) £597 Ios. at 18, £635 at 21, £765 at 25 or over, rising to £1,140. Promotion prospects. Write Civil Service Commission, Burlington Gardens, London, W.1, for application forms, quoting (a) 291/60, (b) 303/60. Closing date 12th September, 1960.

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Maintenance and Operation) (Z.1230)

Oxford District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class J, Grade 11 (£845-£930 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required. work are required.

work are required.

Assistant Engineer (Planning (Z.1234)

Swindon District of No. 2 (Newbury) SubArea. Salary N.J.B. Class G, Grade 10 (£800£875 per annum). N.J.B. conditions of service.

The duties of the post will be to assist the
Planning Engineer in the preparation of schemes
and estimates for extensions of and reinforcement to overhead and underground H.V. and
L.V. networks, and to undertake standby duties
if required. Applicants should possess suitable
technical qualifications.

The successful candidates for the above
appointments will be required to contribute to
the Electricity Supply (Staff) Superannuation
Scheme, if cligible.

Applications for either of these appointments

Applications for either of these appointments on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks, and returned to him, quoting the appropriate "Z" number, not later than 15th August, 1960.

CENTRAL ELECTRICITY GENERATING BOARD.

Design and Construction Department Services Branch

A SSISTANT ENGINEERS (Mechanical or Electrical) required in the Regional Offices of the Production, Inspection and Test Section of the Services Branch. The vacancies may be in any one of the offices located at London, Birmingham, Manchester, Newcastle or Glasgow.

The Section is concerned with the production, inspection and testing in manufacturers' works of mechanical and electrical plant and equipment required for generation (including nuclear) and transmission

Candidates should preferably have qualifications equivalent to Graduate Membership of the Institution of Mechanical or Electrical Engineers. Recent experience in production control methods and inspection and testing of plant in manufacturers' works is desirable.

Salaries on scales within the range £920-£1,140 p.a. according to duties and respon-sibilities, plus £50 London allowance when applicable.

Applications stating age, qualifications, experience, present position and salary to the Personnel Officer, 24/30, Holborn, London, E.C.I, by 18th August. Envelopes should be marked "Confidential Ref. ER/285."

5477

G.W.B. FURNACES LIMITED Control Gear Division

SALES ENGINEER
required for LONDON and the HOME
COUNTIES. He should have experience
of electric motor control gear, contactors,
relays, multi-motor control panels, switch-

This is a senior appointment and a good salary is paid, plus expenses. The position is permanent and pensionable. A company car is provided.

Write in confidence, giving details of age, qualifications and career to date, to:

Sales Manager
Control Gear Division
G.W.B. FURNACES LIMITED
Dudley, Worcs. 5504

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

A.E.R.E. Harwell

Vacancies for **ELECTRONIC MECHANICS** ELECTRO / MECHANICAL INSTRUMENT **MECHANICS**

Some of these vacancies are with the new establishments being built nearby at Culham and the National Institute for Research in Nuclear Science.

The work offered is varied and interesting, and working conditions are excellent. There are outstanding opportunities for advancement. The Authority has sick leave and superannuation schemes and is at present operating a local assisted transport scheme.

Married men living outside the Harwell transport area accepted for the above posts will be housed within a reasonable time.

Please write for explanatory booklet and application forms to

INDUSTRIAL RECRUITMENT OFFICER A.E.R.E., HARWELL DIDCOT, BERKS

5447

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

PPLICATIONS are invited for the following positions:

GRADE 10 ENGINEER (SEC/3.102/ER), MARCHWOOD GENERATING STATION.

That I on.

The person appointed may be required to undertake shift operational work, control room duties, assist on maintenance work or perform general station duties. Previous experience of modern generating plant is desirable.

Applicants should have a sound technical training and possess qualifications leading to corporate membership of an appropriate professional institution or hold equivalent qualifications

Salary N.J.B. L/10, £1,010-£1,130.

GRADE 12 ENGINEER (SEC/3.103/ER), MARCHWOOD GENERATING STATION.

The person appointed may be required to undertake shift operational duties or perform general station duties. Previous experience of modern generating station plant is desirable.

Applicants should have had a sound technical training and preferably possess qualifications leading to corporate membership of an appropriate professional institution or hold equivalent qualifications.

Sallary N.J.B. L/12, £890-£990.

Special application forms, obtainable only from Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 15th August, 1960.

LEEDS COLLEGE OF TECHNOLOGY Calverley Street, Leeds, 1

Principal: C. Chew, M.Sc.Tech., F.R.I.C.

MENIOR LECTURER IN ELECTRICAL ENGINEERING required on 1st September, 1960, or as soon as possible thereafter.

Applicants should have a good degree in the subject with industrial or research experience in electronics and telecommunications.

Burnham Technical Scale of salaries, £1,550-£50-£1,750 a year.

Further particulars and form of application, to be returned as quickly as possible, may be obtained by sending a stamped addressed foolscap envelope to the Principal of the College.

GEORGE TAYLOR, Chief Education Officer.

Education Offices, Calverley Street, Leeds, I.

5450

SOUTH OF SCOTLAND ELECTRICITY BOARD

Fife Area: Surveyor

PPLICATIONS are invited for the post of A PPLICATION'S are invited for the post of SURVIEYOR with the Construction Dept. at East Port, Dunfermline. Applicants should have a varied experience of all types of overhead line construction up to and including 33 kV.

N.J.B. conditions apply. Salary Schedule D, Grade 6, £620 × £20 to £740 per annum. Applications on standard form obtainable from Area Manager, S.S.E.B., East Port, Dunfermline, should be returned to him not later than Friday, 19th August, 1960.

MIDLANDS ELECTRICITY BOARD

PPLICATIONS are invited for the following superannuable posts

Birmingham and District Sub-Area

SENIOR DRAUGHTSMAN (Sub-Area Engineer's Department)

(Headquarters).
Applicants should have had sound experience Applicants should have had sound experience in the preparation of engineering drawings required for the construction and operation of transmission and distribution networks and their associated substations. Knowledge of surveying and mains records routine will be an advantage. Provisional salary £800/£875 per annum within N.J.B. Schechule A.

Apply by letter, within 7 days, stating age, experience, present position and salary to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14, Dale End, Birmingham, 4.

Waggester and District Sub-Area

Worcester and District Sub-Area

Worcester and District Sub-Area
SECOND ASSISTANT DISTRICT
ENGINEERS (Reddirch/Bromsgrove).
Experience necessary in all branches of distribution work including construction, maintenance and operation of high and low-voltage underground and overhead systems and substations, and the planning of system reinforcements and mains extensions.

Technical qualifications desirable. Salary (N.J.B. Grade G.7).

Apply by letter, within 14 days, stating age, experience, present position and salary to Mr. W. B. Willis, District Manager, Midlands Electricity Board, Windsor Road, Reddirch, Worcs.

Worcs.

Worcs.

SECOND ASSISTANT DISTRICT
ENGINEER (Worcester).

Experience necessary in all branches of distribution work including construction, maintenance and operation of high and low-voltage underground and overhead systems and substations. Technical qualifications desirable. Salary £890/£990 per annum (N.J.B. Grade F.7).

Apply by letter, within 14 days, stating age, experience, present position and salary to Mr. E. C. Watson, District Manager, Midlands Electricity Board, P.O. Box No. 16, Blackpole Road, Worcester.

Road, Worcester.

F. W. CATER, Secretary.

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Northern Area

Second Assistant Engineer

A PPLICATIONS are invited for the above appointment in the Area Engineering Department located at Dingwall, Ross-shire. Applicants should have experience in the construction, operation and maintenance of electricity networks in a predominantly rural area.

The successful applicant will be required to undertake general duties principally in the Planning Department.

Salary scale N.J.B. Grade 8, Class G, £890-£990 per annum.

Minimum technical qualification: Higher National Certificate in Electrical Engineering. Superannuation scheme applicable.

Application forms are obtainable from the Area Manager, Church Street, Dingwall, which should be returned by Friday, 12th August, 1960. PPLICATIONS are invited for the above

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

A SSISTANT SHIFT CHARGE ENGIStation. N.J.B. service conditions, superannuable appointment, salary within Schedule A,
Grade G.9, £845-£930 per annum, plus 10%
for shift duties (minimum £90).

A sound technical training and practical
power station experience are required in the
operation of steam generating plant and main
switchgear. Appropriate technical qualifications
an advantage.

an advantage.

an advantage.

Apply, quoting Vacancy No. 200/66MD, on form AE6, available from the Station Superintendent, Ocker Hill Power Station, Bayleys Lane, Ocker Hill, Tipton, Staffs, to be completed and returned not later than 19th August,

Previous applicants need not re-apply. 5481

Situations Vacant (continued)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

General Assistant District Commercial Engineer, Lothians District

Salary N.J.B. Schedule A, Class G, Grade II, £745/£830 per annum

A PPLICATIONS are invited for the appointment of a GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER in the Lothians District, based on Musselburgh, and should be submitted not later than 31st

August, 1960.

Duties will include the installation and opera-

Duties will include the installation and operation of street lighting maintenance, liaison with Local Authority Street Lighting Engineers and the maintenance of records. Applicants should have knowledge of good street lighting practice and be able to carry out photometric tests. Possession of an O.N.C. or equivalent technical qualifications will be an advantage.

Conditions of service are in accordance with the National Joint Board Agreement for the Electricity Supply Industry, and the successful candidate, subject to satisfactory evidence of health, will require to become a contributor to the Board's superannuation scheme.

The successful candidate will require to reside within a reasonable distance of the District Office at Musselburgh.

C. H. A. COLLYNS,

Manager. 5451

CENTRAL ELECTRICITY GENERATING BOARD

Assistant Engineer (Switchgear)

required in the Plant Design Section of the Transmission Design Branch in the Transmission Department at Headquarters, London, S.E.T.

The selected candidate will be engaged in the development of new substations for voltages up to 600 kV of both conventional and advanced designs, and will assist in the standardisation of substations and the type testing of ancillary equipment.

Applicants should have drawing office experience in the layout of high-voltage substations; experience in design and manufacture, or in construction and maintenance of switchgear, is desirable.

Minimum qualifications are Higher National Certificate or equivalent, and Corporate Membership of the I.E.E. will be a recommendation.

Salary on a scale within the range £970-£1,460 p.a. according to duties and responsibilities.

Applications stating age, qualifications, experience, present position and salary to the Personnel Officer, 24/30, Holborn, London, E.C.1, by 22nd August. Envelopes should be marked "Confidential Ref. ER/283."

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

Midlands Division

STATION SHIFT CONTROL ENGINEERS are required at Ocker Hill Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade G.10, £800-£875 per annum, plus £90 shift allowance.

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 201/60MD, on form AE6, available from the Station Superintendent, Ocker Hill, Tipton, Staffs, and return completed by 19th August, 1960. Previous applicants need not re-apply. 5480

ASSISTANT INSTRUMENT ENGINEER ASSISTANT ELECTRICAL ENGINEER

AND

ASSISTANT MECHANICAL ENGINEER

are required by the

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

AT WINDSCALE AND CALDER WORKS, CUMBERLAND

THE Instruments and Electrical posts are associated with the new "Advanced Gas Cooled Reactor," now being built at Windscale, which will be operated at higher temperatures and ratings and is the experimental prototype for the next generation of nuclear power stations.

The duties of the Assistant Instrument Engineer will be to assist in the commissioning and maintenance of particle and radiation detectors; data loggers, closed circuit television, auto-control as well as pressure, temperature and flow measuring devices. This is an excellent opportunity for an engineer or physicist with experience in one or more of these fields to broaden his knowledge.

The Assistant Electrical Engineer will assist in a section providing an engineering service to the reactor, its associated auxiliaries and generating plant. A desire to work on the problems associated with a prototype reactor is an essential requirement.

The Mechanical Post will be to assist in the maintenance of mechanical equipment associated with Calder Hall Nuclear Power Station. This will include responsibility under a Mechanical Engineer for the maintenance of sections of the plant and for special investigations. special investigations.

Applicants must have served a recognised engineering apprenticeship, pupilage, or have had comparable training, and be at least graduate members of an appropriate senior engineering institution, or equivalent.

Salary according to qualifications and experience within the scale £860 at age 25 to f.1,340 p.a.

Contributory superannuation. housing scheme.

Send POSTCARD for application form, quoting reference P/W.34/J7, to RE-CRUITMENT OFFICER, U.K.A.E.A., PRODUCTION GROUP, WINDSCALE WORKS, SELLAFIELD, SEASCALE,

CLOSING DATE, 15th AUGUST, 1960

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

THIRD ASSISTANT ENGINEER (Con-THIRD ASSISTANT ENGINEER (Construction). Applicants should have had a sound practical training and experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment. Experience in 33-kV and in 66-kV construction work and primary substation construction will be of advantage.

Applicants should have obtained the Higher National Certificate in Electrical Engineering or equivalent qualifications.

Salary N.J.B. Class L, Grade 10 (Scale 10), £1,010/£1,130 per annum.

Applications, giving full details of age, quali-

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 19th August, 1960. 5485

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

A PPLICATIONS are invited for the following superannuable N.J.B. appointments:—

The ing superannuable N.J.B. appointments:—
STATION SHIFT CONTROL
ENGINEER, USKMOUTH "A"
POWER STATION
(Vacancy No. 202/ER/60).
Salary Schedule A, initially Class K, Grade
10, Scale 9, £950-£1,055 per annum, plus 10%
shift enhancement, rising progressively to Class
M, Grade 10, Scale 11, £1,080 - £1,215 per
annum, plus 10% shift enhancement.
Applicants should possess H.N.C. or equivalent qualification, and have had operating
experience in a modern power station.

PLANT CONTROL ENGINEERS.

PLANT CONTROL ENGINEERS,
ROGERSTONE POWER STATION
(Vacancy No. 203/ER/60).
Salary Schedule A, Class G, Grade 10,
Scale 6, £800-£875 per annum, plus £90 shift
enhancement.

Experience of operation of modern high-pressure and temperature unit plant desirable. Applicants should possess H.N.C. or equiva-lent qualification.

THE QUARTER OF THE PROPERTY OF THE POWER STATION (Vacancy No. 204/ER/60).

Salary Schedule A, Class F, Grade 10, Scale 5, £745-£830 per annum, plus £90 shift ephancement. enhancement.

enhancement.

Applicants should possess H.N.C. or equivalent qualification, and have had operating experience in a modern power station.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 19th August,

CITY OF BATH

City and Waterworks Engineer's Department

Appointment of Instrument Mechanic

PPLICATIONS are invited from suitably A PPLICATIONS are invited from suitably experienced candidates for the post of INSTRUMENT MECHANIC in the Waterworks Department. Annual salary in accordance with M.D.V. (£650-£715). Post pensionable. The successful candidate will be required to pass a medical examination.

The department is undertaking a programme of capital works involving the use of new electronic instrumentation, particularly in the field of chlorination, flow transmission and telephonic monitoring.

monitoring. The successful candidate will be expected to spend a period of specialised training at each of the suppliers of the instruments during manufacture, and to supervise their installation and

maintenance.
A five-day week will apply.
Applications, giving details of age, experience, present and previous appointments, together with the names and addresses of two referees, addressed to the City and Waterworks Engineer, 8a, Terrace Walk, Bath, should be received not later than Tuesday, 16th August, 1960. Canvassing disqualifies. Applicants must disclose whether they are related to any member or chief officer of the Council.

IARED E. DIXON.

Guildhall, Bath

JARED E. DIXON Town Clerk.

SOUTH EASTERN ELECTRICITY BOARD

(ENIOR ASSISTANT ENGINEER (Planning), Croydon and West Kent Sub-Area Headquarters. Salary N.J.B. Class K, Grade 4, £1,445-£1,605 plus London allowance. Superannuable. Applicants should be Corporate Members of the I.E.E. and have had wide experience of distribution engineering. The duties of the appointment will consist of planning and design of underground and overhead distribution systems up to and including 33 kV, also estimating and preparation of schemes for submission for approval.

Applications, quoting ER and naming two referees, on forms from Croydon and West Kent Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 24th August, 1960.

GEORGE WRAY,

5483

ELECTRICAL SITE ENGINEERS

DESIGN DRAUGHTSMEN

APPLICATIONS are invited from qualified Electrical Site Engineers and Design Draughtsmen to work on nuclear and special engineering development projects in the fields of power distribution and automatic control. The positions are permanent and pensionable and offer a progressive career with the Company.

The Offices occupy pleasant accommodation in a modern building adjacent to Paddington Station.

If you would like to discuss these vacancies with us, please write giving full details of experience, age, etc., to:-

The Office Manager JOHN BROWN (S.E.N.D.) LIMITED

20 Eastbourne Terrace London, W.2

5448

ENGINEERING DESIGNER-DRAUGHTSMEN

A IR MINISTRY Works Designs Branch requires in LONDON and PROVINCES ENGINEERING DESIGNER-DRAUGHTS-MEN experienced in preparation of schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution.

trical distribution.
Candidates should have served recognised apprenticeship or had equivalent training and also have had practical experience. O.N.C. an advantage. Financial assistance and time off given for recognised courses of study. Promotion and pension prospects. 5-day week with 18 days' paid leave per year initially. Overseas tours for which special allowances granted.
Salary in LONDON ranges from £680 (at age 25) to £900 p.a. for men; from £673 to £868 for women. Somewhat lower in PROVINCES. Commencing salary dependent on age, qualifications and experience.

age, qualifications and experience.

age, qualifications and experience.
Applicants, who must be natural-born British
subjects, should write to Air Ministry, W.G.d,
Lacon House, Theobalds Road, London, W.C.I,
or apply to any Employment Exchange quoting
Kings Cross 896, giving age, details of training,
qualifications, full particulars of former posts
held and copies of any testimonials. Candidates
selected will normally be interviewed in London
and certain expenses reimbursed.

252

SOUTH OF SCOTLAND ELECTRICITY BOARD

A PPLICATIONS are invited for a super-annuable position as a SECOND ASSISTANT ENGINEER in the Generation/ Operation-Test Section of the Chief Engineer's Department at Board Headquarters.

Department at Board Headquarters.

The successful candidate will be responsible to the Senior Assistant Engineer in charge of the Test Section for the routine and acceptance testing of turbo-generator boilers and other station plant, together with the non-destructive testing of materials and component parts.

Applicants should preferably possess Corporate Membership of the Institution of Electrical Engineers or the Institution of Mechanical Engineers. Previous experience in the organi-

Engineers. Previous experience in the organisation of power plant testing is very desirable.

Salary N.J.B. Class AX, Grade 5, £1,180/£1,410 per annum.

Applications should be submitted on the standard form which may be obtained from the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, and returned, quoting reference E27/60, not later than 19th August, 1960.

THE COUNTY BOROUGH OF CROYDON EDUCATION COMMITTEE

invites applications from suitably qualified teachers for the following posts from September next or as soon as possible.

Croydon Technical College Fairfield, Croydon, Surrey

Principal:

D. A. Green, M.B.E., B.Sc., M.Ed. ASSISTANTS GRADE "B" for the Department of Electrical Engineering. The subjects required are Electrical Installation Work and Radio, Television and Electronic Servicing, and applicants are asked to say which of these they

can offer.

The salaries for the posts are in accordance with the Burnham Technical Scale of £700-£1,150 plus London area allowance, with appropriate allowances and increments for degree, the salary and previous teaching and industrial

Further particulars and forms of application may be obtained from the Chief Education Officer, Education Offices, Katharine Street, Croydon, and should be returned to the Principal not later than 19th August. 5465

BRANCH MANAGER

required by overseas electrical contracting company for service in Middle East and surrounding

Applicants, aged preferably between 30 and 40, with previous experience of a similar position in U.K., should give full details of their careers. This is a senior appointment and only persons with considerable experience in all aspects of contracting from enquiry to final account can be considered.

Apply in writing to N. G. Bailey & Co. Ltd., Heathcote, Ilkley, Yorkshire.

5466

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

A PPLICATIONS are invited for the following appointment:—

GENERAL ASSISTANT ENGINEERS,
GOLDINGTON GENERATING
STATION (Bedford)
(S.V. No. 1377).
Salary N.J.B. Class H, within the range of
Grades 16/14, £550-£725 per annum plus £90
per annum shift allowance whilst engaged on
shift duties.
Duties include assisting in the electrical con-

shift duties.

Duties include assisting in the electrical control room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc., in a generating station and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of the Ordinary National Certificate or its equivalent will be of advantage. advantage.

Applications, quoting S.V. No. 1377, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 13th August,

ASSISTANT ENGINEER (ELECTRICAL)

ASSISTANT ENGINEER (ELECTRICAL) required for the London Office of the CROWN AGENTS FOR OVERSEAS GOVERNMENTS AND ADMINISTRATIONS for appointment to pensionable establishment on probation for 2 years. Commencing salary between £830 at age 25 and £1,125 at age 34 or over in scale rising to £1,300. Fully qualified officers at least 27 years of age may be eligible for special increase of £75 within maximum of scale after 2 years' service. Liberal leave. Five-day week. Candidates, preferably between 25 and 35 years of age, should have Degree in Electrical Engineering or be Corporate Member of the Institution of Electrical Engineers. They should have received their training with established electrical manufacturer, contractor or undertaking and have had subsequent operating or design experience in either medium-size thermal power stations, transmission and distribution systems, or consumers' installations. Previous contract experience an advantage.

Duties include purchase of electrical plant and equipment, preparation of specifications for tenders, adjudication of tenders and technical correspondence with Administrations.

Write to the Crown Agents, 4, Mill'bank, London, S.W.I. State age, name in block

Write to the Crown Agents, 4, Milbank, London, S.W.I. State age, name in block letters, qualifications and experience, and quote M2A/51092/EF. 5460

TECHNICAL AUTHOR: ADMIRALTY

PENSIONABLE post for man at least 27 PENSIONABLE post for man at least 27 on 1.6.60 to prepare books of reference on photographic equipment. Qualifications: 5 years' apprenticeship followed by 6 years' technical experience. O.N.C. (or equivalent) in electrical or mechanical engineering. Ability to write and illustrate clearly on technical subjects essential. General knowledge of modern photography desirable.

Starting salary (London) £825 (at 27) to £900 (30 or over). Maximum £1,065. Scale under review.

Write Civil Service Commission, 17, North Audley Street, London, W.I, for application form, quoting \$/5160/60. Closing date 25th

HUMPHREYS & GLASGOW

require an electrical assistant to work under an electrical engineer on chemical plant contracts The work covers power, lighting, testing and commissioning. Minimum standard O.N.C

5-day week and contributory pension scheme.

Apply in writing to:

The Chief Engineer

HUMPHREYS & GLASGOW LTD. 22 Carlisle Place, London, S.W.I

5489

Situations Vacant (continued)

SOUTH EASTERN ELECTRICITY BOARD

TITTER (Electrical), Brighton and Hove District. Wages 5s. 14d. per hour for a 42-hour 5-day week under N.J.I.C. Agreement. Candidates should have served a recognised craft apprenticeship and have had experience in the erection and maintenance of high-voltage and medium-voltage switchgear, transformers and associated control equipment. Contributory pension scheme optional.

Applications, quoting ER and naming two referees, to District Manager, SEEBOARD, Electric House, Castle Square, Brighton, by 15th August, 1960.

15th August, 1960.

ASSISTANT DISTRICT ENGINEER, Woking District, Class F, Grade 7, under N.J.B. Agreement. Salary £890 × £20 to £990 per annum. Superannuable. Applicants, who should have a good general education and be technically trained to H.N.C. standard, must have had practical training and experience in general distribution work on systems up to 11 kV and be capable of organising and supervising a full construction and maintenance programme. Ability to plan and prepare schemes for mains extensions would be an advantage.

Applications, quoting ER and naming two referees, on forms from District Manager, SEEBOARD, 4, Chobham Road, Woking, by 17th August, 1960.

GEORGE WRAY,

GEORGE WRAY, Secretary.

5484

CENTRAL ELECTRICITY GENERATING BOARD

Senior Assistant Engineers

A PPLICATIONS are invited for the appointment of SENIOR ASSISTANT ENGINEERS in the Commercial Department at Headquarters, London, S.E.I.

The duties will include assisting in the preparation of estimates of the costs of supply of electricity and of steam, of revenue and capital budgets, and detailed work in connection with bulk supply tariffs and tariffs for steam supplies; the preparation of estimates for short and long-term trading forecasts; the purchase of electricity from outside bodies; investigation of the economic justification of schemes involving capital expendicture. capital expenditure.

Candidates should have a good technical education and engineering experience. Preference will be given to those who are members of a senior engineering institution or possess an engineering degree.

Salaries on scales within the range \pounds 1,475 - \pounds 2,080 p.a., according to duties and responsibilities.

Applications stating age, qualifications, experience, present position and salary to the Personnel Officer, 24/30, Holborn, London, E.C.1, by 19th August. Envelopes should be marked "Confidential Ref. ER/282."

HUDDERSFIELD COLLEGE OF TECHNOLOGY

Principal: Dr. W. E. Scott, M.B.E.

A PPLICATIONS are invited for the post of HEAD OF THE DEPARTMENT OF ELECTRICAL ENGINEERING. Candidates should possess a good degree, should have had experience in industry, and should preferably be Corporate Members of the Institution of Electrical Engineers.

Salary Burnham Scale, Grade II, £1,600 p.a.

by £50 p.a. to £1,800 p.a.

Application forms and further particulars obtainable from the Principal, to whom applications should be returned without delay.

H. GRAY,

Clerk to the Governors.

25th July, 1960.



M.K. ELECTRIC LIMITED

have the following vacancies in their Technical Drawing Office:

DESIGNERS—experienced in the design of small Electrical/Mechanical products for large-quantity manufacture.

DRAUGHTSMEN-with routine Drawing Office experience and preferably in connection with small electrical products-preparing standard drawings, data sheets, etc.

Excellent working conditions in a new drawing office. Five-day week of 37½ hours. . Holiday arrangements honoured and attractive salaries offered according to experience.

Applications treated in strict confidence if addressed to:-

Technical Manager

M.K. ELECTRIC LIMITED

Shrubbery Road, Edmonton, London, N.9

5375

NORTH EASTERN ELECTRICITY BOARD

PPLICATIONS are invited for the following appointments:

CHIEF ENGINEER'S DEPT.
OPERATION AND MAINTENANCE
SECTION, CARLIOL HOUSE

SECTION, CARLIOL HOUSE

SENIOR ASSISTANT ENGINEER to take charge of Electrical Plant Repairs Sub-Section. Applicants should be suitably qualified electrical engineers with extensive experience in testing, repair and maintenance of heavy electrical plant, including all classes of high-voltage switchgear and transformers. Salary Schedule B, new Class AX, Grade 1, £1,600/£1,870. N.J.B. conditions.

Class AA, Grade 1, £1,000/£1,8/0. N.J.B. conditrions.

SENIOR ASSISTANT ENGINEER to take charge of the Communications Sub-Section. Applicants should be suitably qualified Telecommunications Engineers with extensive experience in all branches of communications engineering, including telephony, selective control equipment and VHF radio. Salary Schedule B, new Class AX, Grade 1, £1,600/£1,870. N.J.B. conditions.

Applications stating age, qualifications and experience to be received by Assistant Secretary Board, G.P.O. Box 117, Cardiol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement.

MERSEVSIDE AND NORTH WALES.

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT COMMERCIAL SENIOR ASSISTANT COMMERCIAL ENGINEER required at No. 2 Sub-Area Headquarters, Sandiway House, Northwich, Cheshire. Salary within range £1,575/£1,730 per annum (N.J.B. L/4).

Applicants should have a wide experience of industrial and commercial applications, and the development of domestic and farm supplies, contracting and sales of appliances.

Appropriate technical qualifications essential. Appointment subject to medical examination. Pension scheme.

Pension scheme.

Application forms obtainable from the Manager at the above address. Closing date 19th August, 1960.

5458

TRANSFORMER SALES ENGINEER

R NGINEER required for Transformer Sales and Contracts Office. Preference given to applicants with experience in this class of work, wishing to transfer to sales will be considered.

Apply Sales Director, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Surrey.

SOUTH OF SCOTLAND ELECTRICITY BOARD

Ayrshire Area

General Assistant District Engineer, Ardrossan

A PPLICATIONS are invited for the above A superannuable post. Applicants should preferably possess a National Certificate in Electrical Engineering and have had experience in overhead and underground systems up to 33 kV.

The salary for the post will be in accordance with the N.J.B. Agreement, Class F, Grade 11, £690/£785 per annum.

Applications should be sent to the Area Manager, Mr. G. F. Moore, Greenholm Street, Kilmarnock, not later than 22nd August, 1960.

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER (Tech-

nical) required at No. 3 Sub-Area Headquarters, Chester. Salary £800/£875 per annum (N.J.B. K/13)).

Applicants should have had experience of the testing and commissioning of H.V. cleotrical plant and its associated protective gear, and should be in possession of suitable technical qualifications. qualifications.

Appointment subject to medical examination. Pension scheme.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate Street, Chester, must be forwarded not later than 15th August, 1960. 5457

HOSPITAL MANAGEMENT COMMITTEE FOR ST. FRANCIS AND THE LADY CHICHESTER HOSPITALS

WORKING FOREMAN BLECTRICIAN wanted at St. Francis Hospital, Haywards Heath. Experienced in all systems of wiring. Applicants must also be capable of carrying out electrical testing and repairs, plant maintenance, including automatic telephone system. Experience with electro-medical equipment an advantage.

Rates of pay as laid down by the National Joint Industrial Council for the Electricity Supply Industry and conditions of service as laid down by the Ancillary Staffs Council.

Applications in writing stating age and experience to the Secretary. 5464

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

Appointment of Senior Assistant Engineer **Electrical Measurements Section** Technical Department

A PPLICATIONS are invited for the appointment of a SENIOR ASSISTANT ENGINEER to take charge of the Electrical Measurements Section with location at Darlington.

Candidates should have a wide theoretical and practical knowledge of electrical measurements and be Corporate Members of the Institution of Electrical Engineers. Responsible experience in the application and maintenance of integrating meters and indicating instruments in large high-voltage circuits, and of the administration of this work, is required.

The salary for this appointment (which is

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule B, Class AX, Grade 3 (£1,365-£1,605 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, I, Whitehall Road, Leeds, I, to whom they should be returned to arrive not later than the 22nd August, 2660.

ELECTRICAL TRADE **OVERSEAS MANAGER**

A N opportunity exists with an important Merchant Company in their expanding Electrical Retail and Wholesale business in GHANA handling:—

Radio Receivers. Television.

Domestic Appliances, including Refrigerators and Air Conditioners. Industrial Lighting Material.

Cables, etc., and Allied Equipment for above.

A young man 25/32 years of age, of potential managerial capacity, is required, and whilst the position is basically to supervise and promote sales, applicants should have a good technical knowledge of the above material as an adjunct to primary

Candidates for this vacancy should apply, in confidence, to box number indicated, and should state details of age, experience, education. If married state family. Free quarters, paid leaves, pension scheme.

Box 5490

MINISTRY OF AVIATION

ELECTRICAL ENGINEERS (Assistant Signals Officers), required for LECTRICAL ENGINEERS (Assistant Signals officers) required for aviation telecommunications and electronic navigational aids. Minimum age 23; 1st or 2nd Class Degree in Physics or Engineering, or A.M.I.E.E. or A.F.R.Ae.S. (candidates with Parts I, II and III of A.M.I.E.E. or Parts I and II of A.F.R.Ae.S. or equivalent, or of very high professional attainment without these qualifications considered).

maximum £1,300. Slightly lower outside London and for women.
Further details and forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.I, quoting D.161/OA.

POWER CABLES

OPPORTUNITY occurs for young Technician with good knowledge with good knowledge of the chemical, physical and electrical aspects of Cable Dielectrics to work for progressive oil company on the development of new types of impregnating compounds.

Apply in confidence, giving qualifications, experience and present salary to—Box 5324.

A senior electrical draughtsman required to participate in the planning and installation of a new plant involving H.V. and L.V. switchgear, A.C. and D.C. motors control gear and electronic equipment. Applications stating age, quadifications, training and subsequent experience to the Labour Manager, Barrow Steel Works Limited, P.O. Box No. 16, Walney Road, Barrow-in-Furness, Lancs.

A PPLICATIONS are invited for a position as assistant engineer in the lift and crane special service section of the engineering department, Eagle Star Insurance Co. Ltd., 15/25, Ewell Road, Cheam, Surrey. Candidates should be between 28-35 years, having served a full apprenticeship preferably with a Higher National Certificate, and should be experienced in the construction and design of hifts and cranes; some knowledge of electrics would be an advantage. The position is on the permanent staff with salary according to age and experience and non-contributory pension and contributory widows' pension. Apply in own handwriting, giving age, training and experience, to Acting Chief Engineer, at Cheam.

A PPLICATIONS are invited for post of senior electrical accessories representative for London and the Home Counties area. Preference will be given to the applicant who is well introduced and has a first-class knowledge of the trade. Salary, commission, car and superannuation scheme. Apply — S. O. Bowker Ltd. (Tenby), 19/21, Warstone Lane, Birmingham, 18.

A SSISTANT test engineer for new testing laboratory dealing with electrical wiring accessories, cartridge fuses, etc. Applicants should have at least O.N.C. or equivalent, and have had previous experience in a similar capacity. A good salary will be offered according to age, experience and qualifications. Applications treated in strict confidence if addressed to Technical Manager, M.K. Electric Ltd., Shrubbery Road, Edmonton, London, N.9, 5284

PRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., Longridge House, Manchester, 4. Electrical surveyor required in Scotland. Permanent position c

experience.

CONTRACT accountant required to carry out billing and other accountancy work in connection with electrical contracting. Pension and bonus schemes in operation. Applications stating details of age and experience to—Drake & Gorham (Contractors) Ltd., 36, Grosvenor Gardens, London, S.W.I. 5384

CONTROL circuit engineer and estimator for automatic motor control gear; O.N.C. or H.N.C. desirable with previous experience; permanent and pensionable situation. Apply giving details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey.

DESIGN draughtsman required for interesting work in convenient DESIGN draughtsman required for interesting work in connection with the design of electrical accessories for industrial purposes. Some knowledge of the design of electrical components to British standards and of designing for large - quantity production would be an advantage. South Manchester area. Salary commensurate with qualifications will be paid. Please write giving full details to—Box 5468.

DESIGN engineer for senior position with electrical engineers in Westminster. Applicants must have experience of commercial and industrial installations and instrumentation systems and be capable of designing to customer's requirements, including preparation of specifications. Applications stating age, educational background, qualifications, experience and salary required to—Box 5403.

DRAUGHTSMAN (junior) electro/mechanical; interesting situation with excellent prospects. Apply giving full details of age,

DRAUGHTSMAN (junior) electro/mechanical; interesting situation with excellent prospects. Apply giving full details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey.

ENFIELD-STANDARD POWER CABLES Ltd. contracts department drawing office require senior draughtsman, based Brimsdown (Enfield, Middlesex), experienced preliminary planning and layout cable routes and cable racking systems. Apply (full details) Chief Installation Engineer, Contracts Department, Stockingswater Lane, Brimsdown.

ELECTRICAL engineer required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler & Electrical Insurance Co. Ltd., 98, West George

Street, Glasgow, C.2.

Street, Glasgow, C.2.

LECTRICAL fitters and instrument mechanics with electrical engineering background wanted for assembling, testing and adjusting airblast circuit breakers and precisionadjusting airbiast circuit breakers and precision-made automatic regulators in London S.W.1 district, and for overhauling on site. Preference given to holders of National Certificate. Write giving all relevant particulars to—British Brown-Boveri Limited, 75, Victoria Street, London, S.W.1.

Brying all relevant particulars to—British frownsover Limited, 75, Victoria Street, London, S.W.r.

LECTRICIANS. London contractor has a vacancies for experienced men, capable of working on own initiative. Mates also required.—B. French Limited, 19, Woburn Place, London, W.C.I (Terminus 5143).

NFIELD-STANDARD POWER CABLES Ltd. contracts department require qualified electrical engineer to plan systems and layouts of power and control cables associated with major industrial installations and to commission the circuits after installation. Apply to Contracts Manager, Brimsdown, Middlesex.

Stop

NFIELD-STANDARD POWER CABLES

Ltd. contracts department require a senior and a junior electrical draughtsman for work associated with the layout of power and control cables associated with major industrial installations. Apply to Contracts Manager, Brimsdown, Middlesex.

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VERSHED & VIGNOLES Ltd. require young engineers of O.N.C. electrical engineering terminated distributed installations and represented for their instrument divisions applied to the property of the property of

Evershied & Vignoles Ltd, require young engineers of O.N.C. electrical engineering standard for their instrument division contracts department. Expanding opportunities for advancement. Write—Personnel Manager (Ref. 115c), Acton Lane Works, Chiswick, London, W.4.

Experience of the contract of the cont

London, W.4.

Experience Destinator and supervising engineer required for medium-sized expanding firm of electrical contractors. Progressive appointment leading to executive position for the right man. Write giving full details of training and experience, in confidence, to—Dudley Bower & Co. Ltd., Bower House, Briset Street, London, E.C.I.

I IGHTING. Required for lighting promodion, staff with imagination, personality, ability to write technical copy, and an aptitude for public speaking. Based in London, the successful applicants will be expected at times to travel the country. Salary according to experience and qualifications. Contributory superannuation scheme.—The British Lighting Council, Brettenham House, 16-18, Lancaster Place, London, W.C.2.

ARITIME company in Geneva requires qualified electrical engineer fully conversant with all marine installations and, if possible, also refrigeration installations. Applications with qualifications and salary requirements to—Box 5493.

Box 5493.

PROGRESS and production control planning

PROGRESS and production control planning engineer wanted, experience essential, for works office of telephone manufacturers, S.W. London.—Box 5470.

ENIOR and junior electrical design engineers' office. 5-day week, luncheon vouchers, spring and summer holidays. Applicants for senior positions must be experienced in design of electrical services for modern hospitals, universities, factories, etc. Please apply stating age, experience and salary required to—J. Stinton Jones & Partners, 21, Gloucester Place. London. W.I.

UPERVISING engineer required for well-known London electrical contractor, able to handle, works.

SUPERVISING engineer required for well-known London electrical contractor, able to handle works of any size from estimate to account. Apply stating age, experience and salary required to—Box 5512.

SURVEYOR, preferably young man, for transmission line and civil engineering projects. Some experience on either or both.—Miller & Stables, 15, Duncan Street, Edinburgh, 9. 5452

TRANSFORMER designer required for large established factory in Bombay to work as TRANSFORMER designer required for large established factory in Bombay to work as manager responsible for design and manufacture of transformers up to 15 MVA and 132 kV. Good academic qualifications with minimum 10 years' experience essential. Age 30 to 40 years, contract. Excellent prospects. Apply with full particulars, including salary required, to—Box 5473.

Situations Vacant (continued)

TECH. sales assist. engineer with good Nat.

TECH. sales assist engineer with good Nat. Cert. qualifications and preferably with some experience to sell transformers, capacitors and fuse switchgear to industry in Southern England. Salary, commission, expenses, with good prospects.—Box 5472.

TRANSFORMER representative for the electronic and industrial transformer fields. Preference will be given to a person already engaged in a similar capacity. Salary plus commission. Car will be supplied.—Willesden Transformer Co. Ltd., Manor Park Road, London, N.W.10 (Elgar 5445).

YOUNG man of good education, technical training and experience with electric motors and generators, to handle correspondence, esti-

raining and experience with electric motors and generators, to handle correspondence, estimates and orders at London office. Apply in writing, giving full details of age, education, training, experience and salary required to—Higgs Motors Ltd., 109, Kingsway, London, W.C.2. 5471

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

SITE foreman seeks change. Complete supervision; all fields of contracting. Very excellent references.—Box 7575.

ARTICLES FOR SALE

MOTORS

NEW CROMPTON PARKINSON, from ½ h.p. to 80 h.p.; also 6,000 A.C. and D.C. reconditioned Motors and Starters. IN STOCK HERE

B. E. WHITE Brantwood Rd., Tottenham, London, N.17 Tel. EDMonton 4621-2 215

HOUSE SERVICE METERS

200 -240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO. 221, City Road, London, E.C.1

A.A. ELECTRICAL Co. for A.C.-D.C.

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI.5105. 67, Rothschild Rd., London W4. 57

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 200 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 440 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish, vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622).

& Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622).

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9).

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

A LTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

A LTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

B ARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5).

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.I (Tel. ROYal 5905). 316

(MRCUIT breakers, various sizes in stock, CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.I. 26 CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150 CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.I. 22 Britannia Mfg. Co. Ltd., Britannia Walk, London, N.I.

Britannia Mfg. Co. Ltd., Britannia Walk, London, N.I.

LECTRIC motors and generating equipment.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 116

LECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.I. (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

LECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

LECTRICIANS. Send for details Shaftes-

Ltd., Belgrave Electrical Works, Leeds, 2.

LECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builderstype ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4).

III

LAMEPROOF A.C. motors in stock from \$\frac{1}{4}\$ h.p. to 50 h.p., 3-phase, 50 cycles, 400 volts.—Thomas Mitchell & Sons Ltd. (Phone, Bolton 301).

Bolton 301).

TLUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunk-

E.C.I.

GENERATING sets, portable or stationery,
I new and reconditioned, I to 100 kW, A.C.
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I48

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd.,
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OTOR generator sets and converters, all
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in stock. — Britannia Manufacturing Co. Ltd.,
22-26, Britannia Walk, City Road, London, N.1

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OTORS and control gear, huge stocks all

MOTORS and control gear, huge stocks all types, 4 to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). NAMEPLATES, engraving, diesinking, sten-cils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry.

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.T.

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1.

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PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.I. 15
PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. F. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52
UARTERLY credit meters, single and polyphase, 2½-100 amps. From 20/-. Also D.C. See Television.—Tradex, Surbiton. 171
DOTARY converters in stock, all sizes;

D.C. See relevision.—Fracex, Surbiton.—171.

POTARY converters in stock, all sizes;
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221, City Road, London, E.C.I.

MALL BR screws and nuts in steel, brass
and stainless steel, from stock.—Premier
Screw & Repetition Co. Ltd., Woodgate,

Television Solution Co. Ltd., Woodgate, 180
Television slotmeters and time switches.
Details from: Tradex Meter Co., Surbiton (Elmbridge 2234/5/6). 172
Two 600-kW rectifier sets by E.C.C., 1,250
amps. output; with induction regulators amps. output; with induction regulators and transformers; 3-phase/6-phase. — Thomas Mitchell & Sons Ltd. (Phone Bolton 301, 3

ines).
VENNER time switches, 200-240 v., A.C./
D.C., 10-50 amps., from stock.—Universal
Electrical Co., 221, City Rd., London, E.C.1. 38
WARD Leonard motor generating sets, all
sizes.—Britannia Manufacturing Co. Ltd.,
22-36, Britannia Walk, London, N.1 (Tel.
Clerkenwell 5512).
2-speed motor, 40/20 h.p., 950/480 r.p.m.,
T.E.F.C. slipring type by L.D.C. with Igranic
automatic control panel. Further details from—
Dynamo & Motor Repairs Ltd., North End
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78
10 O.-h.p., 970-r.p.m. T.E.F.C. slipring

Road, Wembley Park. 78
180 -h.p., 970-r.p.m. T.E.F.C. slipring
motor by Lancashire, 400 v., 3-phase,
50 cycles, complete with fully automatic starting
panel. Further details from—Dynamo & Motor
Repairs Ltd., North End Road, Wembley

Park.

100 and alternators.—Britannia Mfg. Co.
Ltd., Britannia Walk, London, N.I.

27500 -kW, 220-volt Met.-Vick. rotary converses, so cycles, and accessories.—Britannia Mfg. Co.
Ltd., Britannia Walk, London, N.I.

27500 -kW, 220-volt Met.-Vick. rotary converses, so cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.I.

17500 /625-kW L.D.C. generator, 240 volts, interpole with single bearing for direct coupling at 1,000 r.p.m., or on combination bed with new L.D.C. slipring motors, 900 h.p., 990 r.p.m., 3.3 kV or 6.6 kV, complete with switchgear, in approximately six months. Also duplicate generator and spare armature. Further details from Dynamo & Motor Repairs Ltd., North End Road, Wembley.

84

SALES BY AUCTION

37th Sale

By instructions from the Secretary of State

R.A.F., STAFFORD (on the main Sandon road, 2 miles from Stafford Town Centre)

SOUTH & STUBBS

are instructed to Sell by Auction on WEDNESDAY, 24th AUGUST, 1960

at 11 a.m. at Headquarters Site, R.A.F., Stafford a Large Quantity of

SURPLUS GOVERNMENT STORES

including Aero and Radio Spares, Diesel and Petol Engines, Karrier, Commer, Leyland, Standard, Austin, Ford and Bedford Engines and Spares, Aero and M.T. Engine Spares, Nylon Parachutes, Generator Sets, Cycles, Packing Cases, etc.

On View Monday and Tuesday, 22nd and 23rd August, from 10 a.m. to 4 p.m., and morning of Sale to 11 a.m.

Catalogues 1s. each (P.O. only), from the Auctioneers' Offices:

28, Eastgate Street, Stafford (Tel. 2331/2)

Forty-First Sale



By Order of the Secretary of State for Air

No. 25 MAINTENANCE UNIT, ROYAL AIR FORCE, HARTLEBURY, Worcestershire (4 miles from Kidderminster, 11 miles from Worcester).

NOCK & JOSELAND
are instructed to Sell by Auction at the above
Unit on

THURSDAY, 11th AUGUST, 1960 at 11 a.m. prompt

a Large Quantity of VALUABLE MISCELLANEOUS STORES

VALUABLE MISCELLANEOUS STORES including Clothing and Equipment, Footwear, Rubber Dinghies, Parachutes, RADIO AND ELECTRICAL EQUIPMENT, Cameras, Epidiascopes and Photographic Equipment, Office and Mess Furniture, Aircraft Equipment and General Stores.

VIEWING: With the exception of 4 Lots of Furniture which are on view at the Royal Air Force Station, Bridgnorth, the lots are on view at Hartlebury on Tuesday and Wednesday, 9th and 10th August, 1960, between the hours of 9 a.m. and 4 p.m., and on the morning of the Sale Day between the hours of 8 a.m. and 11 a.m.

Admission only on production of Catalogue, which will admit TWO PERSONS on the View Days and ONE PERSON on the Sale Day. The Secretary of State for Air reserves the right to refuse admission.

Catalogues, price ONE SHILLING EACH (Postal Orders, NOT Stamps) can be obtained from the Auctioneers:

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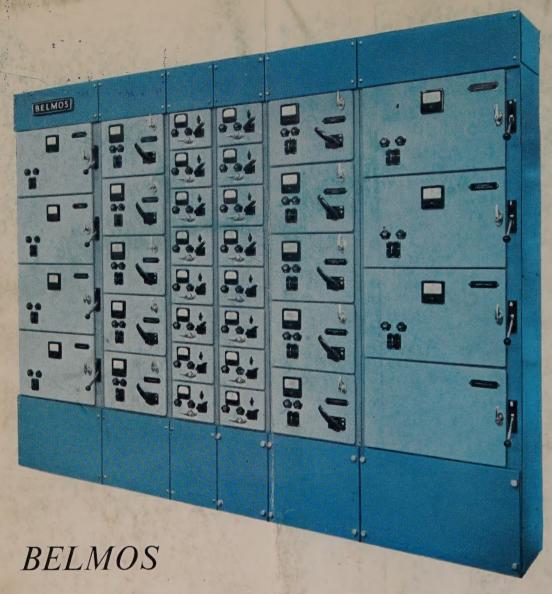


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